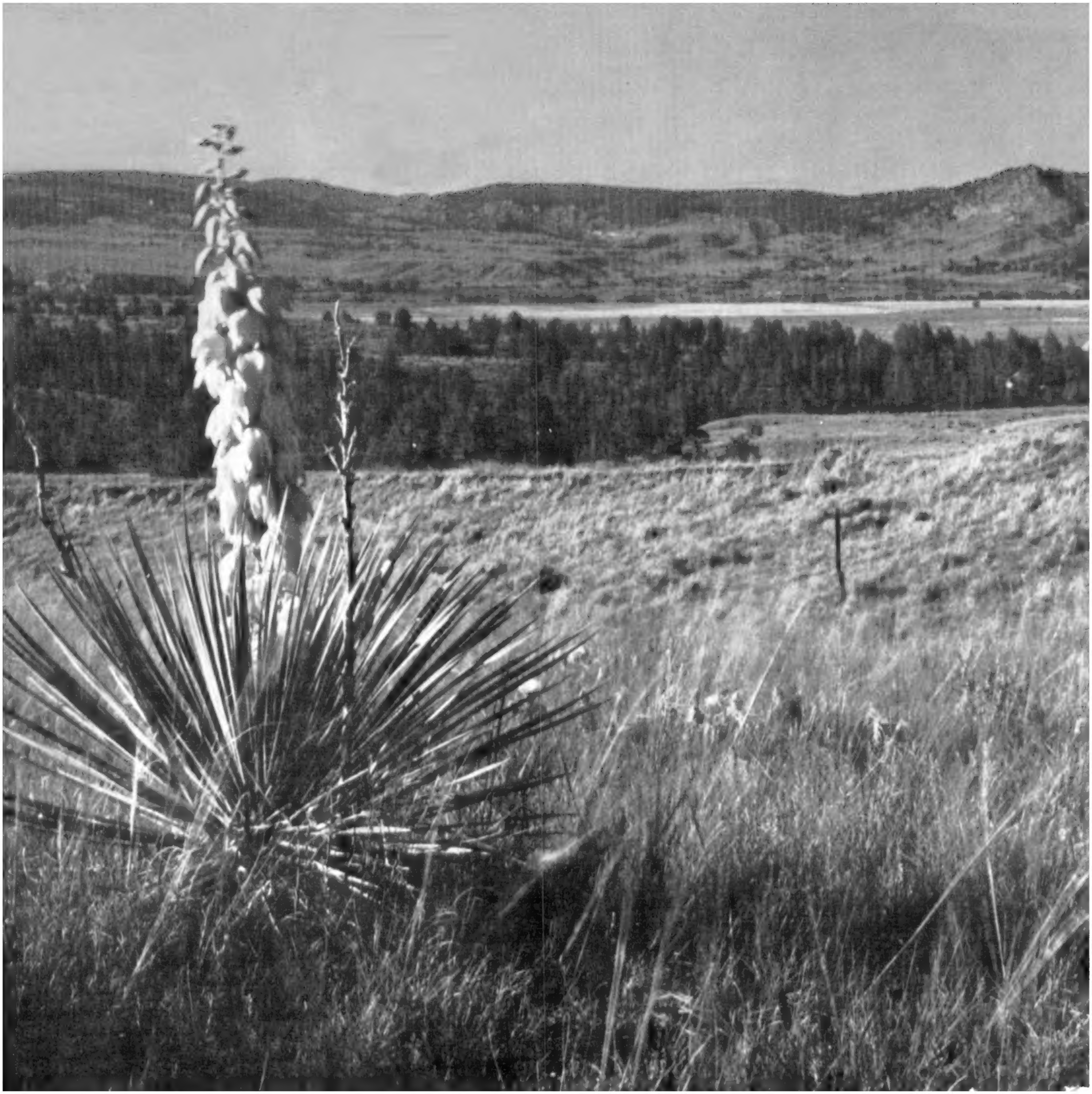
United States
Department of
Agriculture

Soil
Conservation
Service and
Forest Service

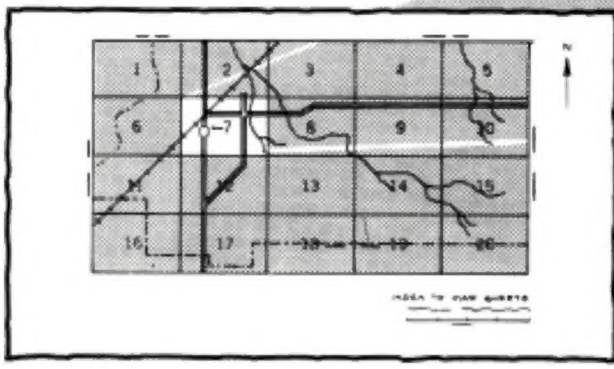
in cooperation with
the South Dakota
Agricultural
Experiment
Station

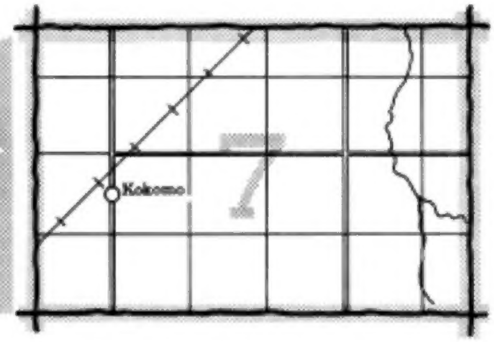
Soil Survey of Fall River County South Dakota



HOW TO USE

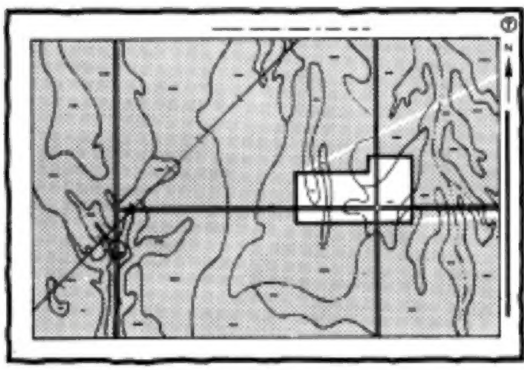
1. Locate your area of interest on the "Index to Map Sheets"

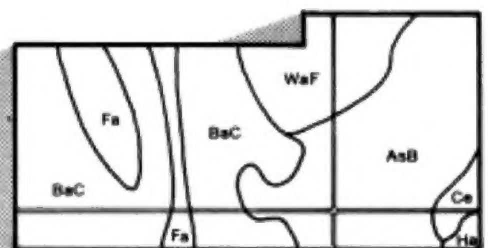




2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





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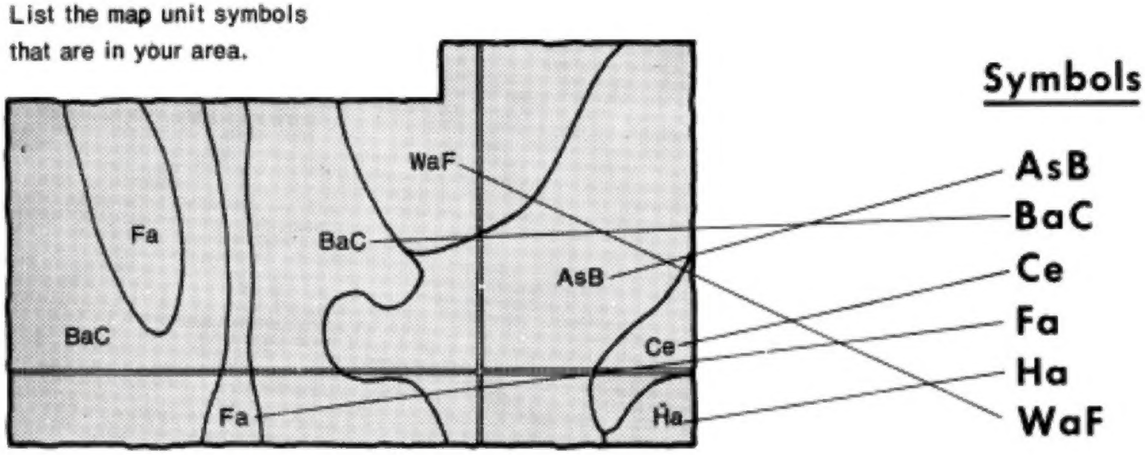
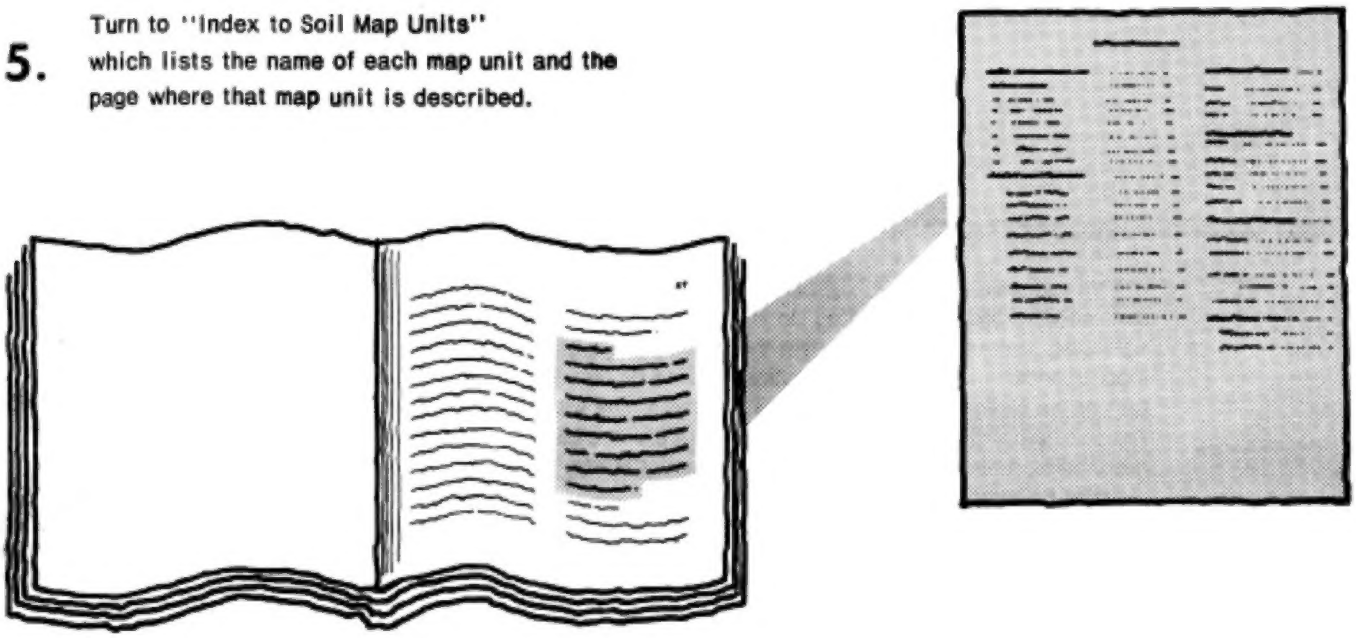
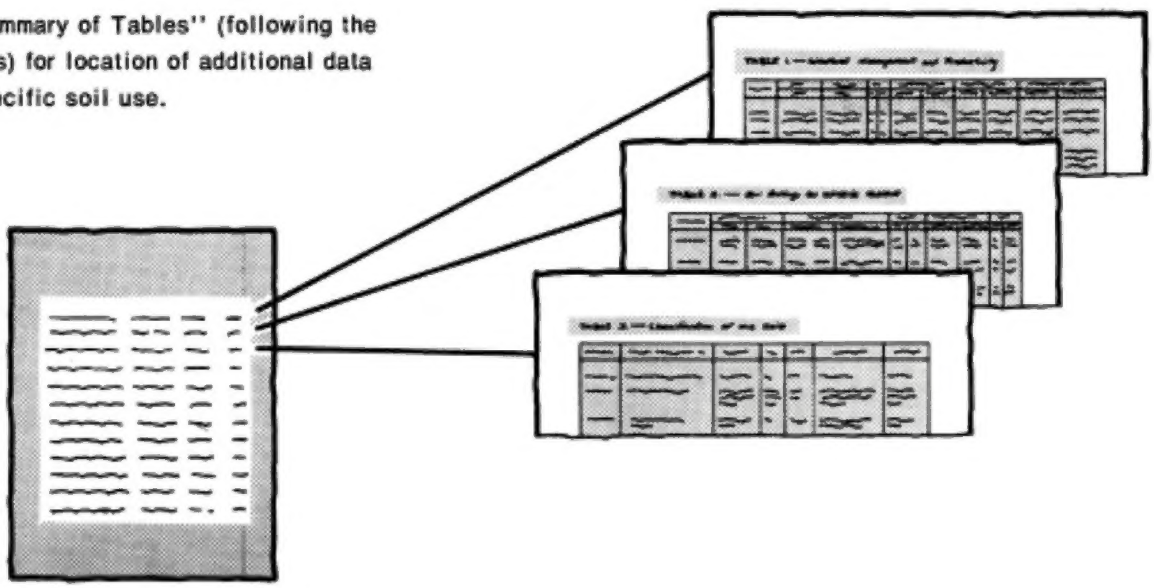


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Fall River Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue and the Fall River Board of County Commissioners. The soil survey was initiated in 1961, but major fieldwork was performed in the period 1974-79. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Yucca plant on Valent soils on uplands adjacent to the flood plain along the Cheyenne River. The Black Hills are in the background.

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foreword

This soil survey contains information that can be used in land-planning programs in Fall River County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

R. D. Swenson

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State Conservationist
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soil survey of
Fall River County, South Dakota

By John Kalvels, Soil Conservation Service

Soils surveyed by John Kalvels, Roland K. Krauss, and J. T. Schladweiler, Soil Conservation Service, and Wayne Record, South Dakota Division of Conservation

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with the South Dakota Agricultural Experiment Station

FALL RIVER COUNTY is in the southwest corner of South Dakota (fig. 1). It has a total land area of 1,115,584 acres, or about 1,743 square miles. Angostura Reservoir, near the center of the county, is 5,056 acres. About 276,000 acres is Federal land administered by the Forest Service.

According to the 1970 census, the county has a population of 7,505. Hot Springs, the county seat, has a population of 4,434 and Edgemont, in the west-central part of the county, one of 1,174. Other towns and villages are Ardmore, Oelrichs, Oral, Provo, and Smithwick.

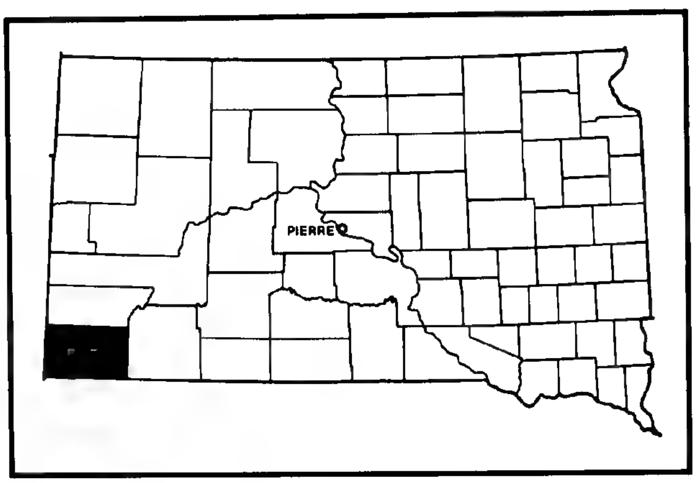

Figure 1.—Location of Fall River County in South Dakota.

general nature of the county

This section gives general information concerning the county. It describes climate; physiography, relief, and drainage; settlement; farming; and natural resources.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Fall River County is usually warm in summer, but hot spells are frequent and cool days occasional. In winter cold periods occur when arctic air moves in from the north and northwest. They alternate with milder periods, which often occur when northwesterly winds are warmed as they move down slopes. Most of the precipitation falls during the warm period, and rainfall is normally heaviest late in spring and early in summer. Winter snowfall is frequent. In all areas except for the higher elevations, the snow cover usually melts during mild periods.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Oelrichs, South Dakota, in the period 1951 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is about 26 degrees F, and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Oelrichs on February 7, 1971, is -30 degrees. In summer the average temperature is about 71 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Oelrichs on July 6, 1973, is 114 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 16.46 inches. Of this, 12.76 inches, or 77 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 10 inches. The heaviest 1-day rainfall during the period of record was 4.36 inches at Oelrichs on May 23, 1971. Thunderstorms occur on about 42 days each year, and most occur in summer. Tornadoes and severe thunderstorms strike occasionally. These storms are local in extent and of short duration and result in severe damage in narrow belts. Hailstorms occur occasionally in scattered small areas during the warmer part of the year.

Average seasonal snowfall is 42 inches. The greatest snow depth at any one time during the period of record was 16 inches. On an average of 31 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the north-northwest. Average windspeed is highest, 13 miles per hour, in spring.

physiography, relief, and drainage

Fall River County is in two major physiographic divisions of South Dakota (*7*). The north-central part is in the Black Hills division of the Great Plains. The rest is in the Pierre Hills division of the Great Plains. The Black Hills consists of tree covered mountains that rise as much as 1,600 feet above the surrounding landscape. The Pierre Hills generally are gently sloping to strongly sloping but are steep along drainageways.

The Cheyenne River and its tributaries drain most of the county. The southeast part, however, is drained by tributaries to the White River. Angostura Dam, in an area on the Cheyenne River south of Hot Springs, impounds water for irrigation. Most of the small drainageways outside the Black Hills are intermittent. Water flows in these drainageways after heavy rains in the spring. The Cheyenne River and the larger drainageways in the Black Hills are perennial.

Elevation ranges from about 3,000 feet above sea level in the northeastern part of the county to 4,848 feet on Parker Peak in the Black Hills.

settlement

The settlement of Fall River County dates back to the discovery of gold in the Black Hills (*5*). Although no gold was discovered in the county, many of the early settlers were miners and explorers. The village of Minnekahta was established as a health resort near an area of warm springs in the southern part of the Black Hills. It is now called Hot Springs.

Fall River County is named after a river in the county. It was established in 1883 by an act of the Dakota Territory Legislature. Hot Springs was selected as the county seat. By 1890, the county had a population of 4,478. In 1940, it had one of 8,089, and by 1960, it had one of 10,688, the highest population in its history. The State Veterans Home and a Veterans Administration hospital are located in Hot Springs.

South Dakota State Highways 71, 79, 89, and 471 and United States Highways 18 and 385 are the main thoroughfares. Many rural areas are served by poor motor roads and trails. Small airports are at Edgemont and Hot Springs. Two railways provide railroad service.

farming

Ranching is the principal enterprise in Fall River County. About 76 percent of the farm income is derived from the sale of livestock and livestock products. Many of the crops are used as feed for livestock. In 1974, rangeland and cropland totaled 920,400 acres, which is about 83 percent of the total acreage of the county. The 320 farms and ranches averaged 3,045 acres in size (*6*). The average size has been increasing since 1930.

About 8 percent of the acreage in the county is used for cultivated crops or for tame pasture and hay, and about 83 percent is range (*3*). About 8 percent is native woodland. Dryland farming is dominant. Winter wheat is the main dryland crop. It is grown in rotation with summer fallow. Grain sorghum and oats are grown on a small acreage. Alfalfa is grown where moisture conditions are favorable. Alfalfa and corn are the main irrigated crops. According to the South Dakota Crop and Livestock Reporting Service, corn was grown on about 6,000 acres in 1979. Nearly all of this acreage was irrigated. Oats was grown on about 7,100 acres and winter wheat on 16,700 acres. About 75 percent of the

acreage planted to corn was harvested for grain. The rest was used for silage.

Some or all of the land on about 64 farms is irrigated. Angostura Dam, which was completed in 1950, impounds water used to irrigate about 12,000 acres along the Cheyenne River. Farmland in the Angostura Irrigation Project produces a considerable amount of the local farm income.

The Fall River Conservation District, which was organized in 1941, has been instrumental in planting trees to provide protection for farmsteads and to help control wind erosion.

natural resources

Soil is the most important resource in the county. It provides a growing medium for cultivated crops and for grass grazed by livestock. Other natural resources are wildlife, timber, oil, uranium, and sand and gravel.

Angostura Reservoir is an excellent source of water for recreation, domestic and industrial use, and irrigation. The areas along the Cheyenne River below the dam commonly are irrigated. In most parts of the Black Hills in Fall River County, water is adequate for domestic use and for watering livestock. On the prairie outside the Black Hills, small dams supply water to livestock.

Recreation is an important source of income in Fall River County. In summer the Black Hills are used by many tourists for hiking, fishing, camping, and sightseeing. In fall and winter they are used for hunting, snowmobiling, and skiing. Angostura Reservoir provides opportunities for boating, swimming, water skiing, fishing, and camping.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied to a depth of 5 feet and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 10 associations in the county have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. The names of some associations do not agree with those on the general soil maps in the published soil surveys of adjacent Shannon County. The names do not fully agree because of differences in the detail of the general soil maps and because of changes in the application of the soil classification system.

soil descriptions

Gently sloping to very steep, stony and loamy soils on mountains and uplands in the Black Hills

These soils dominantly are steep and very steep but are gently sloping in mountain valleys and near drainageways. They make up about 15 percent of the county. About 50 percent of the acreage is forest. A few areas of the minor soils are used for cultivated crops, mainly alfalfa and small grain.

1. Mathias-Butche-Rockoa association

Deep and shallow, well drained, gently sloping to very steep, stony and loamy soils on mountains and uplands

This association is characterized by rocky ridges, narrow, rolling plateaus, deeply entrenched drainageways, almost vertical canyon walls, and narrow mountain valleys. Slopes generally are steep and very steep but are gently sloping to strongly sloping on narrow plateaus and in mountain valleys. Many stones and boulders are on the surface.

This association makes up about 13 percent of the county. It is about 30 percent Mathias soils, 15 percent Butche soils, 15 percent Rockoa soils, and 40 percent minor soils (fig. 2).

The deep Mathias soils dominantly are on south- and west-facing slopes below sandstone outcrops on mountainsides. Slopes range from 15 to 70 percent. Typically, the surface layer is dark grayish brown extremely stony very fine sandy loam. The subsurface layer is light brownish gray and brown very fine sandy loam. The subsoil is light brown and reddish yellow very fine sandy loam and fine sandy loam in which the content of stones and coarse rock fragments is, by volume, about 50 percent. The underlying material is reddish yellow fine sandy loam in which the content of stones and coarse rock fragments is, by volume, about 55 percent.

The shallow Butche soils generally are on the higher lying broad plateaus and ridgetops. Slopes range from 6 to 50 percent. Typically, the surface layer is brown fine sandy loam. The underlying material is light yellowish brown channery fine sandy loam. Very pale brown sandstone is at a depth of about 9 inches.

The deep Rockoa soils dominantly are on north- and east-facing slopes below sandstone outcrops on mountainsides and in covelike areas. Slopes range from 25 to 60 percent. Typically, the surface layer is dark grayish brown extremely stony fine sandy loam. The subsurface layer is light brownish gray fine sandy loam. The subsoil is light brown and brown fine sandy loam and sandy clay loam in which the content of stones and rock fragments is, by volume, about 40 percent. The underlying material is light yellow fine sandy loam in which the content of stones and rock fragments is, by volume, about 50 percent.

Minor in this association are Barnum, Boneek, Haverson, Midway, and Norka soils and Rock outcrop. The silty Barnum soils are on low terraces and flood plains near drainageways. The silty Boneek soils are on the less sloping foot slopes of high terraces. The loamy Haverson soils are on flood plains along small drainageways. The shallow Midway soils are underlain by calcareous, clayey shale. The silty Norka soils are on

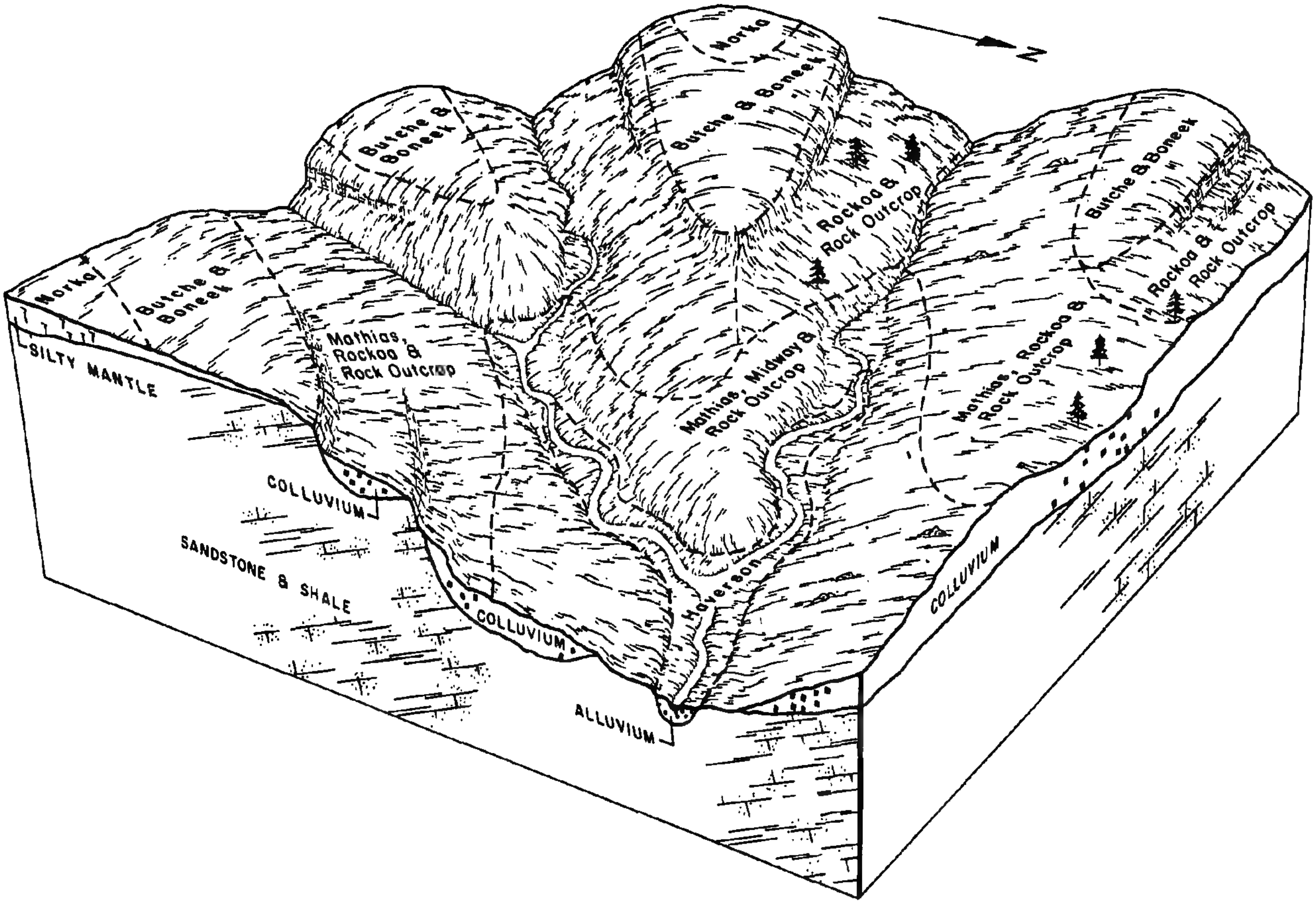

Figure 2.—Pattern of soils in the Mathias-Butche-Rockoa association.

terraces and fans. The Rock outcrop occurs as rimrock or vertical canyon walls near areas of Butche and Mathias soils.

About 55 percent of the acreage of the major soils is forest and 45 percent range. Much of the forest is grazed. Scattered ponderosa pine grow in most areas of the Mathias soils. Some of the minor soils are used for small grain and hay. Lumber, railroad ties, pulpwood, and fenceposts are the main timber products. Uranium ore is mined in some areas of the Mathias and Rockoa soils. Controlling erosion by maintaining an adequate plant cover is the main concern of management.

This association is well suited to woodland wildlife habitat and poorly suited to rangeland and openland wildlife habitat. The major soils are fairly well suited to range and woodland. They generally are unsuited to cultivated crops and to tame pasture and hay. They are poorly suited to building site development and septic tank absorption fields because of the stoniness and the slope. The shallowness to bedrock in the Butche soils also is a limitation. Some of the minor soils are suited to building site development and septic tank absorption fields.

2. Paunsaugunt-Vanocker association

Shallow and deep, well drained, strongly sloping to very steep, loamy soils on mountains

This association is on mountains characterized by ridges and deeply entrenched drainageways that have very steep sides. Slopes generally are very steep but are strongly sloping on the wider ridges.

This association makes up about 2 percent of the county. It is about 45 percent Paunsaugunt soils, 30

percent Vanocker soils, and 25 percent Rock outcrop and minor soils.

The shallow Paunsaugunt soils dominantly are on ridges and in rimrock areas. Slopes range from 9 to 60 percent. Typically, the surface layer is dark grayish brown and grayish brown, calcareous gravelly loam. The underlying material is light brownish gray, calcareous channery loam. Hard limestone is at a depth of about 14 inches.

The deep Vanocker soils dominantly are on side slopes below the Paunsaugunt soils. Slopes range from 15 to 60 percent. Typically, the surface layer is dark grayish brown, calcareous gravelly loam. The subsoil is brown, calcareous gravelly loam and channery loam. The underlying material is light yellowish brown, calcareous channery loam. Fragments of rock are throughout the soil.

Minor in this association are the deep, silty Boneek soils on high ridges; the shallow, reddish Spearfish soils in areas below the Paunsaugunt soils; the deep, silty Tilford soils in slight sags and swales on the lower parts of the landscape; and Rock outcrop in scattered areas on the higher parts of the landscape.

About 95 percent of the acreage of the major soils is forest. Much of the forest is grazed. Scattered ponderosa pine grow in most areas of the Paunsaugunt soils. The Vanocker soils support a fair stand of ponderosa pine. Some of the minor soils are used for small grain and hay. Lumber, railroad ties, pulpwood, and fenceposts are the main timber products. Controlling erosion by maintaining an adequate plant cover is the main concern of management.

The Paunsaugunt soils are fairly well suited to range and poorly suited to woodland. The Vanocker soils are poorly suited to range and fairly well suited to woodland. Both soils are well suited to woodland wildlife habitat and poorly suited to rangeland and openland wildlife habitat. They generally are unsuited to cultivated crops and to tame pasture and hay, building site development, and septic tank absorption fields because of the slope of both soils and the shallowness to bedrock in the Paunsaugunt soils.

Nearly level to steep, silty, loamy, and clayey soils on uplands

These soils dominantly are nearly level to moderately sloping but are steeper along drainageways and on some ridges. They make up about 8 percent of the county. About 55 percent of the acreage is range. Winter wheat and alfalfa are the main crops. Some areas are irrigated.

3. Tilford-Spearfish association

Deep and shallow, well drained, nearly level to steep, silty and loamy soils on uplands

This association is in broad mountain valleys characterized by small ridges and knolls. In places drainageways have cut deeply into the landscape. Slopes generally are nearly level to moderately steep but are steep on some of the ridges.

This association makes up about 2 percent of the county. It is about 30 percent Tilford soils, 15 percent Spearfish soils, and 55 percent minor soils.

The deep Tilford soils are on uplands and terraces. Slopes range from 0 to 9 percent. Typically, the surface layer is reddish brown silt loam. The subsoil is reddish brown, red, and light red, very friable silty clay loam and silt loam. The underlying material is red, calcareous silt loam.

The shallow Spearfish soils are on the steeper parts of the landscape. Slopes range from 9 to 50 percent. Typically, the surface layer is reddish brown loam. Below this is reddish brown and light red, calcareous shaly loam. Light red siltstone is at a depth of about 17 inches.

Minor in this association are the silty, stratified Barnum soils on low terraces and flood plains; the deep, silty Boneek soils in swales; the moderately deep Gystrum soils on the lower side slopes; the deep, silty Nevee soils on fans and terraces; and the shallow Rekop soils, which are on the tops and upper sides of ridges and are underlain by gypsum bedrock. Also of minor extent are areas where red siltstone crops out. These areas are intermingled with areas of the Spearfish soil.

About 90 percent of the acreage of Tilford soils and all of the acreage of Spearfish soils are range. A few scattered ponderosa pine grow on the Spearfish soils. Alfalfa and small grain are the main crops in cultivated areas of the Tilford soils. Conserving moisture and controlling erosion are the main concerns of management.

The Tilford soils are well suited to cultivated crops and to range, tame pasture and hay, and openland and rangeland wildlife habitat. The Spearfish soils are fairly well suited to range and rangeland wildlife habitat. They generally are unsuited to cultivated crops and to tame pasture and hay. The Tilford soils are better sites for buildings and septic tank absorption fields because the Spearfish soils are too steep and are shallow over bedrock.

4. Kadoka-Orella-Bufton association

Moderately deep, shallow, and deep, well drained, nearly level to steep, silty and clayey soils on uplands

This association is on uplands that are dissected by small drainageways. Slopes generally are moderately sloping and strongly sloping but are nearly level to gently sloping in some areas and moderately steep and steep in others. The drainage pattern is well defined in most areas.

This association makes up about 1 percent of the county. It is about 35 percent Kadoka and similar soils,

30 percent Orella and similar soils, 20 percent Bufton soils, and 15 percent minor soils.

The moderately deep Kadoka soils are on the middle and lower parts of the landscape. Slopes range from 0 to 15 percent. Typically, the surface layer is grayish brown silt loam. The subsoil is dark grayish brown and pale brown, friable and firm silty clay loam and silt loam. The underlying material is very pale brown, calcareous silt loam. Very pale brown siltstone is at a depth of about 36 inches.

The shallow Orella soils are on side slopes below areas of Rock outcrop. Slopes range from 6 to 30 percent. Typically, the surface layer is light brownish gray, calcareous silty clay. Below this is light gray, calcareous clay. White shale is below a depth of about 18 inches.

The deep Bufton soils are on foot slopes below the Orella soils. Slopes range from 2 to 6 percent. Typically, the surface layer is light brownish gray silty clay loam. The subsoil is light brownish gray and light gray, calcareous silty clay loam. The underlying material is very pale brown, calcareous silty clay loam.

Minor in this association are the shallow Epping soils on the higher parts of the landscape and bare areas of Badland on the steep sides of entrenched drainageways. Also of minor extent are the calcareous Haverson soils on flood plains along intermittent drainageways and the clayey Pierre soils on the lower foot slopes in the uplands.

Nearly all of this association is range. Controlling erosion and runoff is the main management concern.

This association is well suited to range and to rangeland wildlife habitat. The less sloping areas of Kadoka and Bufton soils are fairly well suited to cultivated crops, but the Orella soils generally are unsuited. The Kadoka and Bufton soils are better sites for buildings and sanitary facilities because the Orella soils are shallow over bedrock and are too steep. The moderate depth to bedrock in the Kadoka soils and a high shrink-swell potential and restricted permeability in the Bufton soils are limitations.

5. Norka association

Deep, well drained, nearly level to moderately sloping, silty soils on uplands

This association dominantly is gently sloping and moderately sloping but is nearly level in some areas. The drainage pattern is well defined in most areas.

This association makes up about 5 percent of the county. It is about 60 percent Norka soils and 40 percent minor soils (fig. 3).

The Norka soils dominantly are on the smooth parts of the landscape. Slopes range from 0 to 9 percent. Typically, the surface layer is brown silt loam. The subsoil is brown and light gray silt loam and silty clay loam. The underlying material is light gray, calcareous silt loam.

Minor in this association are Ascalon, Boneek, Colby, Hoven, and Savo soils. The loamy Ascalon soils are in positions on the landscape similar to those of the Norka soils. Boneek and Savo soils contain more clay in the subsoil than the Norka soils. Boneek soils are on high terraces, and Savo soils are in swales and on foot slopes. The calcareous Colby soils are on the higher side slopes and ridges. The poorly drained Hoven soils are in depressions.

Most of this association is cropland. Winter wheat is the main crop, but small grain and forage crops are grown in some areas. Controlling erosion in the more sloping areas and conserving moisture are the main management concerns. This association is well suited to cultivated crops and to range, openland wildlife habitat, rangeland wildlife habitat, building site development, and septic tank absorption fields.

Nearly level to strongly sloping, sandy and loamy soils on uplands

These soils dominantly are gently sloping to strongly sloping but are nearly level in places. They make up about 9 percent of the county. About 55 percent of the acreage is range. Small grain and alfalfa are the main crops.

6. Dailey-Ascalon association

Deep, somewhat excessively drained and well drained, nearly level to strongly sloping, sandy and loamy soils on uplands

This association makes up about 9 percent of the county. It is about 30 percent Dailey soils, 20 percent Ascalon soils, and 50 percent minor soils (fig. 4).

The slopes of the somewhat excessively drained Dailey soils range from 0 to 12 percent. Typically, the surface layer is dark grayish brown fine sand. The subsurface layer is brown fine sand. The underlying material is grayish brown and pale brown fine sand.

The slopes of the well drained Ascalon soils range from 0 to 9 percent. Typically, the surface layer is brown fine sandy loam. The subsoil is brown, yellowish brown, and pale brown, very friable fine sandy loam and sandy clay loam. The underlying material is light gray, calcareous fine sandy loam.

Minor in this association are Altvan, Arvada, Jayem, Nunn, Satanta, and Valent soils. The well drained Altvan soils are in positions on the landscape similar to those of the Ascalon soils. They are underlain by gravelly sand. The Arvada soils have a sodium affected subsoil. They are on flats along drainageways and in swales. The well drained Jayem soils occur as areas intermingled with areas of the major soils. The well drained, loamy Nunn soils are on terraces, alluvial fans, and foot slopes. The well drained, silty Satanta soils are on terraces. The excessively drained Valent soils are on knolls, ridges,

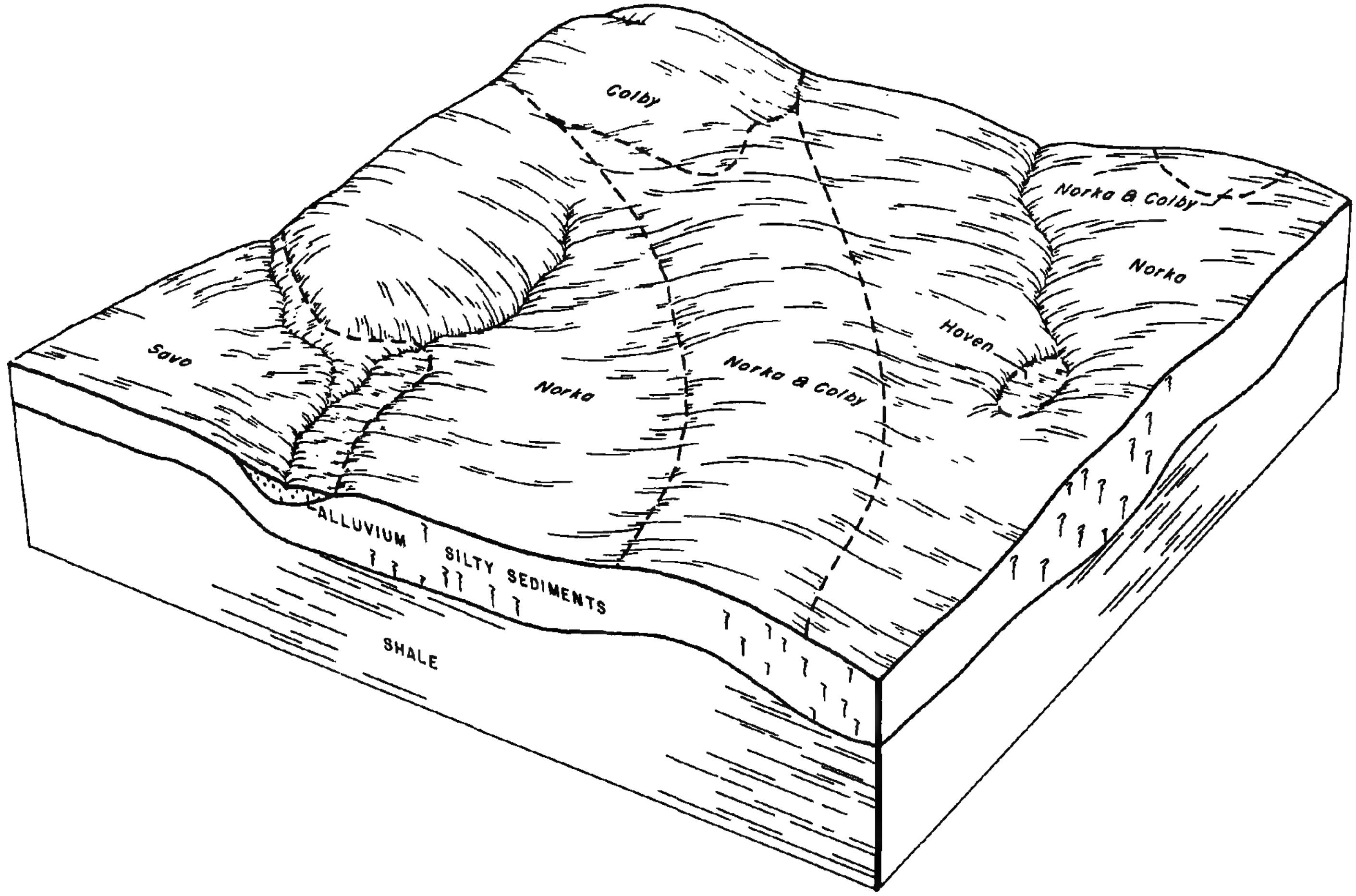

Figure 3.—Pattern of soils in the Norka association.

and sandhills. Also of minor extent are the calcareous, loamy Alice soils; the calcareous, silty Colby soils on the higher parts of side slopes and ridges; the silty Norka soils; the gravelly Schamber soils on steep terrace escarpments and on ridges; and scattered gravel pits in areas of the Schamber soils.

Most of this association is range, but many areas are cultivated. Winter wheat and alfalfa are the main crops. Controlling wind erosion is the main management concern if these soils are cropped.

This association is well suited to range and to rangeland wildlife habitat. The loamy soils are fairly well suited to cultivated crops and to openland wildlife habitat. The major soils generally are well suited to most kinds of building site development. The Ascalon soils are well suited to septic tank absorption fields. The Dailey soils are poorly suited, however, because they do not adequately filter the effluent.

Gently sloping to steep, clayey and silty soils on uplands

These soils dominantly are gently sloping to moderately steep but are steep along drainageways and near the Black Hills. They make up about 65 percent of the county. Most of the acreage is range.

7. Pierre-Samsil association

Moderately deep and shallow, well drained, gently sloping to steep, clayey soils on uplands

This association is on uplands that are dissected by many intermittent drainageways. The drainage pattern is well defined. Slopes generally are gently sloping to moderately steep but are steeper on the sides of drainageways. Landslides are common on the steep breaks along the Cheyenne River.

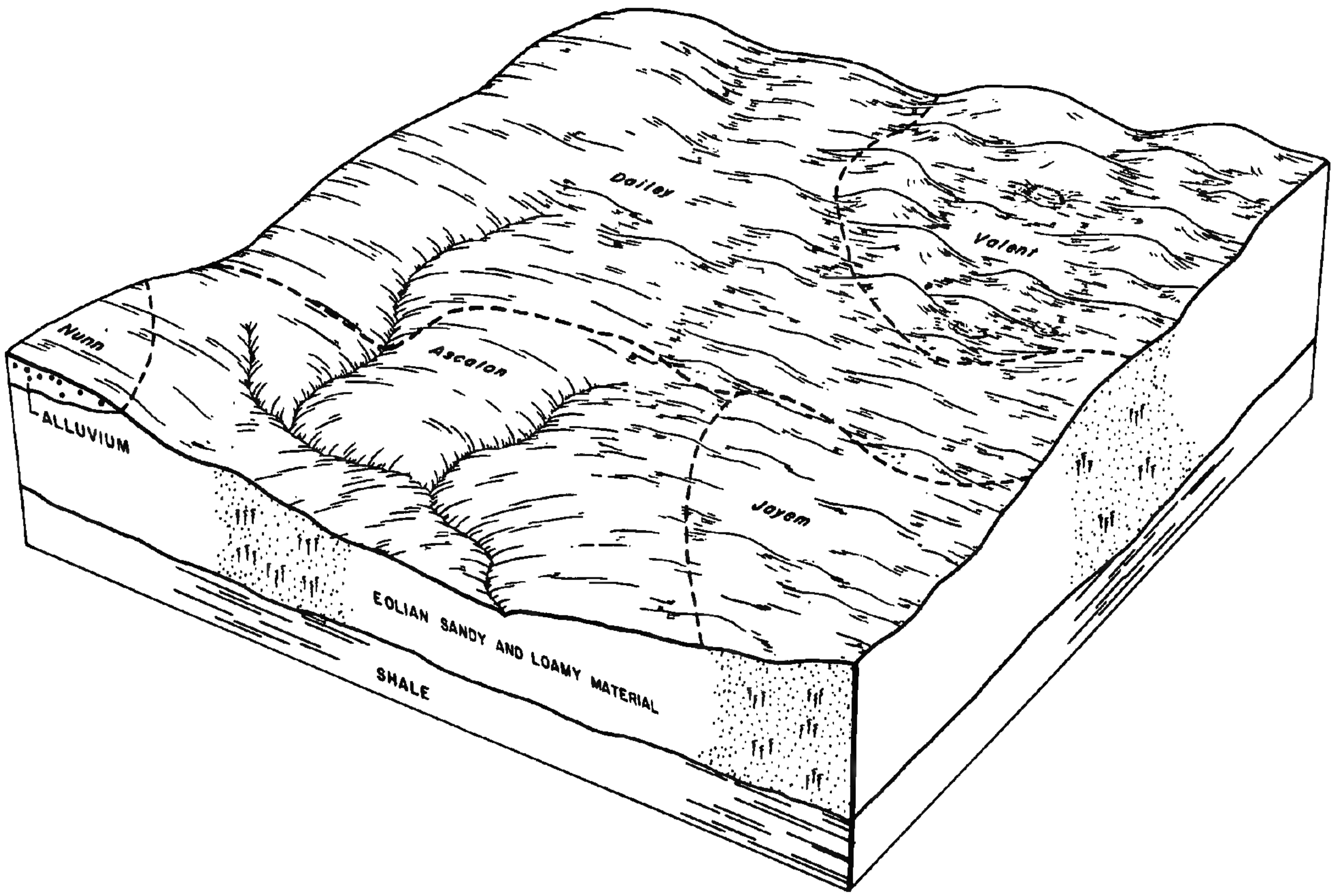

Figure 4.—Pattern of soils in the Dailey-Ascalon association.

This association makes up 48 percent of the county. It is about 40 percent Pierre soils, 35 percent Samsil soils, and 25 percent minor soils (fig. 5).

The moderately deep Pierre soils are on the less sloping parts of the landscape. Slopes range from 2 to 25 percent. Typically, the surface layer is grayish brown clay. The subsoil is light brownish gray, very firm, calcareous clay. The underlying material is light brownish gray, calcareous shaly clay. Light brownish gray shale is at a depth of about 34 inches.

The shallow Samsil soils are on the more sloping parts of the landscape. Slopes range from 6 to 40 percent. Typically, the surface layer is light brownish gray, calcareous clay. The underlying material is light brownish gray and light gray, calcareous shaly clay. Light gray shale is at a depth of about 18 inches.

Minor in this association are Hisle, Kyle, Nihill, Savo, Swanboy, Zigweid, and Winler soils and Slickspots. Hisle soils have a sodium affected subsoil. They are on foot slopes and in narrow valleys along intermittent drainageways. The deep, clayey Kyle soils and the deep, silty Savo soils are on terraces and fans. The excessively drained, loamy Nihill soils and the well drained, loamy Zigweid soils are on ridges and terrace escarpments. The clayey Winler soils have visible salts in the subsoil. They occur as areas intermingled with areas of the Pierre soils. Slickspots are on foot slopes and stream terraces and occur as areas intermingled with areas of the Hisle soils. Also of minor extent are the poorly drained Hoven soils in depressions; the deep, dense, clayey Swanboy soils on terraces and alluvial fans; and outcrops of shale bedrock in some areas of the Samsil soils.

Most of this association is range. A few of the less sloping areas of the Pierre soils are cultivated. Winter wheat is the main crop. The main management concern is controlling erosion.

This association is well suited or fairly well suited to range and rangeland wildlife habitat. It is poorly suited to cultivated crops and to openland wildlife habitat. It is poorly suited to building site development because of a very high shrink-swell potential and the limited depth to shale. It generally is unsuited to septic tank absorption fields because of restricted permeability and the limited depth to shale.

8. Minnequa-Grummit association

Moderately deep and shallow, well drained, gently sloping to steep, silty and clayey soils on uplands

This association is on uplands dissected by many drainageways. Slopes generally are gently sloping and moderately sloping but are steeper near the drainageways.

This association makes up about 17 percent of the county. It is about 35 percent Minnequa soils, 22 percent Grummit soils, and 43 percent minor soils.

The moderately deep Minnequa soils generally are on the less sloping parts of the landscape. Slopes range from 2 to 25 percent. Typically, the surface layer is grayish brown, calcareous silt loam. Below this is a transition layer of light grayish brown, calcareous silty clay loam. The underlying material is pale brown, calcareous silty clay loam. Light gray limestone is at a depth of about 24 inches.

The shallow Grummit soils generally are on the steeper parts of the landscape. Slopes range from 3 to 40 percent. Typically, the surface layer is light brownish gray, very strongly acid clay. The underlying material is grayish brown, extremely acid shaly clay. Light gray, extremely acid shale is at a depth of about 11 inches.

Minor in this association are Broadhurst, Lohmiller, Manvel, Midway, Penrose, Shingle, Snomo, and Stetter

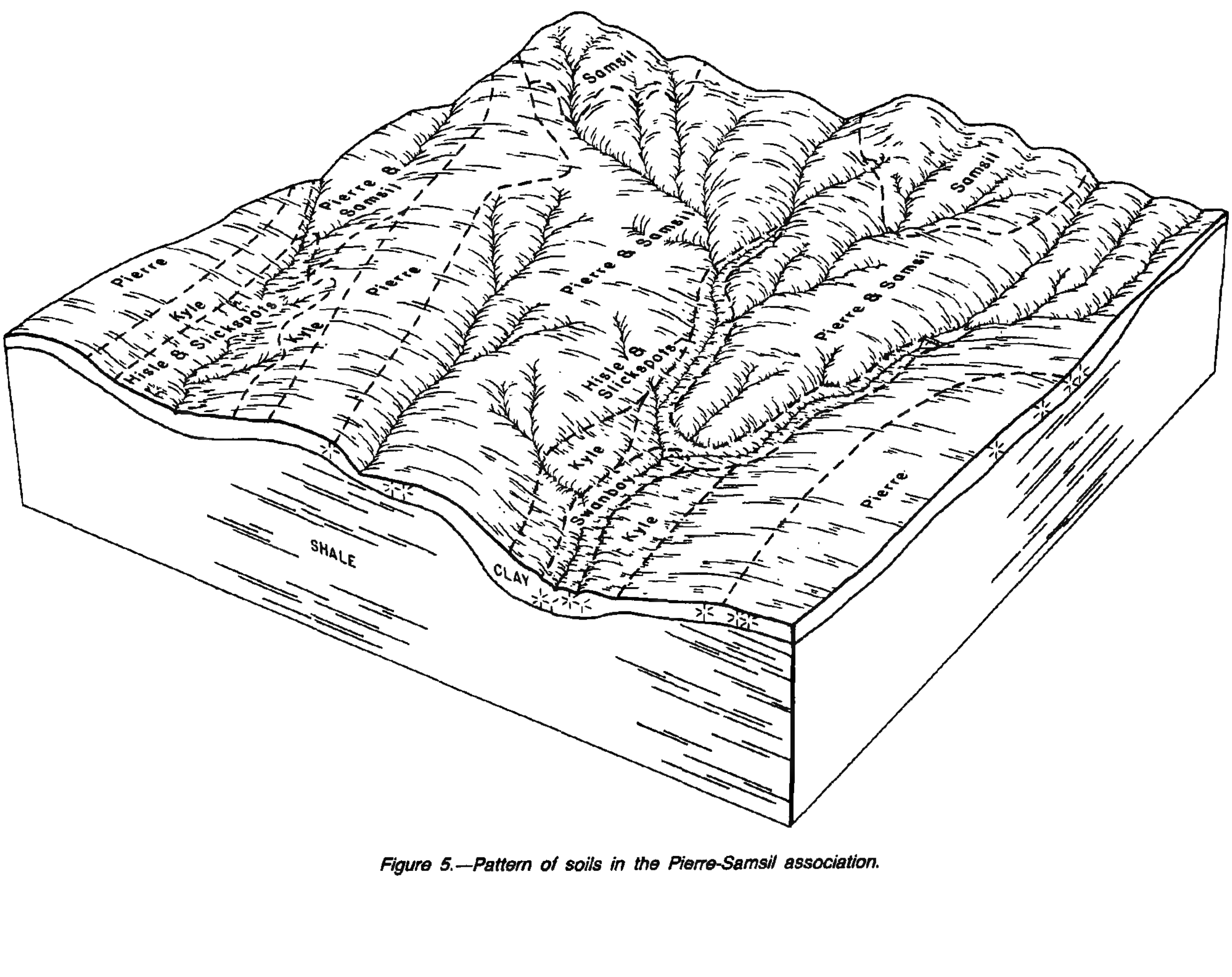

Figure 5.—Pattern of soils in the Pierre-Samsil association.

soils. The deep, dense, clayey Broadhurst soils are on alluvial fans and terraces. The deep, silty Lohmiller soils and the deep, clayey Stetter soils are on flood plains. The deep, calcareous Manvel soils are on foot slopes and alluvial fans. The shallow, calcareous Midway, Penrose, and Shingle soils are on the upper sides of drainageways. The deep, clayey Snomo soils occur as areas intermingled with areas of the Grummit soils.

Most of this association is range. Some areas of the Minnequa soils are cultivated. Winter wheat and alfalfa are the main crops. The main management concerns are conserving moisture and controlling erosion.

This association is fairly well suited to range and to rangeland wildlife habitat. It is poorly suited to openland wildlife habitat. The Minnequa soils are poorly suited and the Grummit soils generally unsuited to cultivated crops. The Minnequa soils are only fairly well suited to building site development because of the moderate depth to bedrock. The Grummit soils are poorly suited to building site development because of the slope, the limited depth to bedrock, and a high shrink-swell potential. Both soils are poorly suited to septic tank absorption fields because bedrock is within a depth of 40 inches.

Nearly level, loamy and silty soils on flood plains

These soils generally are nearly level but are steeper on the short escarpments separating different levels of the flood plains. They make up about 3 percent of the county. Most of the acreage is range. Alfalfa is the main crop.

9. Glenberg-Bankard association

Deep, well drained and somewhat excessively drained, nearly level, loamy soils on flood plains

This association is on the flood plain along the Cheyenne River. It makes up about 2 percent of the county. It is about 50 percent Glenberg soils, 30 percent Bankard soils, and 20 percent minor soils.

The well drained Glenberg soils typically have a surface layer of light brownish gray, calcareous fine sandy loam. The underlying material is light brownish gray, calcareous fine sandy loam stratified with thin layers of very fine sandy loam, silt loam, and gravelly sandy loam. Slopes are less than 2 percent.

The somewhat excessively drained Bankard soils are adjacent to the stream channel. Typically, the surface layer is light brownish gray, calcareous fine sandy loam. The underlying material is light brownish gray, calcareous loamy sand stratified with thin layers of sandy loam and sand. Slopes are less than 2 percent.

Minor in this association are the loamy Haverson soils and the silty Lohmiller soils. Both of these soils are in positions on the landscape similar to those of the Glenberg soils.

Most of this association is range. Alfalfa and small grain are grown in some areas of the Glenberg soils.

This association is well suited to range and rangeland wildlife habitat. It is poorly suited to cultivated crops and to openland wildlife habitat. It is poorly suited to building site development and septic tank absorption fields because it is subject to flooding.

10. Lohmiller-Haverson association

Deep, well drained, nearly level, silty and loamy soils on flood plains

This association is on flood plains along the smaller drainageways in the county. A deep meandering channel dissects most areas into small tracts.

This association makes up about 1 percent of the county. It is about 50 percent Lohmiller soils, 25 percent Haverson soils, and 25 percent minor soils.

The silty Lohmiller soils typically have a surface layer of grayish brown silty clay loam. The underlying material is grayish brown, calcareous, stratified clay loam. Slopes are less than 2 percent.

The loamy Haverson soils typically have a surface layer of grayish brown, calcareous loam. The underlying material is grayish brown, calcareous, stratified loam, clay loam, silt loam, fine sandy loam, loamy fine sand, and loamy sand. Slopes are less than 2 percent.

Minor in this association are the Absted, Arvada, Bankard, and Stetter soils. Absted and Arvada soils have a sodium affected subsoil..The somewhat excessively drained Bankard soils are near the channels. The clayey Stetter soils are in positions on the landscape similar to those of the Lohmiller soils.

Most of this association is range. Winter wheat and alfalfa are the main crops. Conserving moisture is the main management concern if these soils are cropped.

This association is well suited to range and rangeland wildlife habitat. It is fairly well suited to cultivated crops and to openland wildlife habitat. The major soils are poorly suited to building site development and septic tank absorption fields because they are subject to flooding.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and identifies the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kyle clay, 2 to 6 percent slopes, is one of several phases in the Kyle series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Pierre-Samsil clays, 6 to 25 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badland is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and suitabilities for many uses. The Glossary defines many of the terms used in describing the soils.

The names of some of the map units delineated on the detailed maps of this county do not fully agree with those delineated on the maps in the soil survey of adjacent Shannon County. Differences result from variations in the design and composition of map units or from changes in the application of the soil classification system.

soil descriptions

Aa—Absted silt loam. This deep, well drained, nearly level soil is in drainageways, on terraces, and on fans. It has a claypan subsoil and has some microrelief. Areas are long and narrow and 15 to 140 acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is light brownish gray silt loam about 3 inches thick. The subsoil is about 16 inches thick. The upper part is grayish brown, very firm silty clay loam and silty clay, and the lower part is light brownish gray, firm, calcareous silty clay. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay loam. It has few to common accumulations of salts and carbonate throughout. In some areas the dark surface layer is thicker. In other areas the surface layer is thinner.

Included with this soil in mapping are small areas of Kyle soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Kyle soils are on scattered slight rises. Their subsoil contains more clay than that of the Absted soil and is not sodium affected. The Slickspots are nearly bare and are low on the landscape.

Fertility is medium and the content of organic matter moderate in the Absted soil. Tilth is poor. The sodium affected subsoil adversely affects root growth. Available water capacity is moderate. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most of the acreage is range. This soil is only fairly well suited to native grasses because of the dense claypan subsoil. The native vegetation dominantly is western wheatgrass, blue grama, and needleandthread. Overused areas are dominated by blue grama, buffalograss, and saltgrass.

This soil is poorly suited to cultivated crops. The best suited crops are those that are tolerant of drought and sodium salts. Early maturing small grain is better suited than row crops. The main concerns in managing cropland are improving tilth, increasing the rate of water intake, and conserving moisture. Subsoiling helps to break up the dense claypan subsoil and increases the rate of water intake for a short time. Leaving crop residue on the surface, including grasses and legumes in the cropping system, and applying animal manure conserve moisture and improve tilth. Planting green manure crops also improves tilth and increases the content of organic matter.

This soil is poorly suited to windbreaks and environmental plantings. Optimum growth, survival, and vigor are unlikely because of the dense, sodium affected subsoil.

This soil is poorly suited to most kinds of building site development. The high shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability, this soil is poorly suited to septic tank absorption fields. These fields generally do not function well unless they are greatly enlarged. Sewage lagoons are a suitable alternative.

The capability unit is IVs-2; Claypan range site.

AaC—Alice fine sandy loam, 2 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on terraces and uplands. Areas are irregular in shape and 40 to 140 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown fine sandy loam about 10 inches thick. The subsoil is pale brown, very friable fine sandy loam about 12 inches thick. The underlying material to a depth of 60 inches is very pale brown, calcareous fine sandy loam and loamy very fine sand. In places, the surface layer is less than 7 inches thick and lime is at or near the surface. In some areas the underlying material is not calcareous. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Dwyer soils on the convex parts of the landscape. These soils make up less than 10 percent of any one mapped area. They contain more sand between depths of 10 and 40 inches than the Alice soil and have a lighter colored surface layer.

Fertility is medium and the content of organic matter moderate in the Alice soil. Available water capacity is moderate. Permeability is moderately rapid. Runoff is slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is prairie sandreed, little bluestem, needleandthread, western wheatgrass, and sand bluestem. Overused areas are dominated by blue grama, needleandthread, sedges, and western wheatgrass.

This soil is poorly suited to cultivated crops. Measures that control wind erosion and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, including grasses and legumes in the cropping system, contour stripcropping, and establishing field windbreaks.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Keeping crop residue on the surface during site preparation helps to control wind erosion. Planting on the contour helps to control water erosion.

This soil is well suited to building site development, but the sides of shallow excavations tend to cave in unless they are shored. Septic tank absorption fields function well in this soil.

The capability unit is IVe-7; Sandy range site.

AbA—Altvan loam, 0 to 2 percent slopes. This well drained, nearly level soil is on terraces. It is moderately deep over gravelly sand. Areas are irregularly shaped or oblong and are 10 to 90 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown loam about 6 inches thick. The subsoil is about 18 inches thick. It is brown, very friable loam in the upper part; brown, firm clay loam in the next part; and pale brown, very friable loam in the lower part. The upper 9 inches of the underlying material is white loam. The lower part to a depth of 60 inches is very pale brown, calcareous gravelly sand. The lower part of the subsoil and the upper part of the underlying material are calcareous and have many accumulations of lime. In some areas the subsoil contains more clay, and in other areas it contains less clay. In places the soil is redder throughout.

Included with this soil in mapping are small areas of Alice and Satanta soils. These soils make up less than 10 percent of any one mapped area. Alice soils contain less clay in the subsoil than the Altvan soil. Also, they are higher on the landscape. Satanta soils do not have

gravelly sand within a depth of 40 inches. They are in positions on the landscape similar to those of the Altvan soil.

Fertility is medium and the content of organic matter moderate in the Altvan soil. Available water capacity is low or moderate. Permeability is moderate above the gravelly sand and very rapid in the gravelly sand. Runoff is slow.

About half of the acreage is cropland. Unless irrigated, this soil is poorly suited to cultivated crops because it is somewhat droughty. Some areas are irrigated. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, green needlegrass, blue grama, and needleandthread. Overused areas are dominated by blue grama, needleandthread, and sedges.

This soil is poorly suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water. The soil is a probable source of sand and gravel for use as road construction material.

The capability unit is IVs-1; Silty range site.

AbB—Altvan loam, 2 to 6 percent slopes. This well drained, gently sloping soil is on terraces. It is moderately deep over gravelly sand. Areas are irregularly shaped or oblong and are 10 to 90 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown loam about 6 inches thick. The subsoil is about 18 inches thick. It is brown, very friable loam in the upper part; brown, firm clay loam in the next part; and pale brown, very friable loam in the lower part. The upper 9 inches of the underlying material is white loam. The lower part to a depth of 60 inches is very pale brown, calcareous gravelly sand. The lower part of the subsoil and the upper part of the underlying material are calcareous and have many accumulations of lime. In some areas the subsoil contains more clay, and in other areas it contains less clay. In places the soil is redder throughout.

Included with this soil in mapping are small areas of Alice and Satanta soils. These soils make up less than 10 percent of any one mapped area. They do not have gravelly sand within a depth of 40 inches. They are in positions on the landscape similar to those of the Altvan soils.

Fertility is medium and the content of organic matter moderate in the Altvan soil. Available water capacity is low or moderate. Permeability is moderate above the gravelly sand and very rapid in the gravelly sand. Runoff is medium.

About half of the acreage is cropland. Unless irrigated, this soil is poorly suited to cultivated crops. Some areas are irrigated. The main management needs are measures that control water erosion and conserve moisture. Examples are contour stripcropping, leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, green needlegrass, blue grama, and needleandthread. Overused areas are dominated by blue grama, needleandthread, and sedges.

This soil is poorly suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting on the contour helps to conserve moisture.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water. The soil is a probable source of sand and gravel for use as road construction material.

The capability unit is IVe-2; Silty range site.

Ap—Aquolls, nearly level. These deep, very poorly drained, nearly level soils are in slight depressions on flood plains and in upland swales where seepage water has accumulated. They are ponded part of the year. A meandering channel dissects most areas. Areas are 15 to 100 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown loam, but it ranges from loamy sand to clay. The underlying material is stratified fine sand to clay. In places a thin layer of partly decomposed organic material is at the surface.

Fertility and the content of organic matter are high. Available water capacity also is high. A water table is at or near the surface most of the year. As much as 2.0 feet of water ponds on the surface during some wet periods. Runoff is ponded.

Most areas support native vegetation and are used as wetland wildlife habitat. The natural plant cover is a luxuriant stand of bulrushes, reedgrasses, and sedges. Many areas are potential sites for excavated ponds.

These soils generally are unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. They are unsuitable as sites for buildings and sanitary facilities because of the ponding.

The capability unit is VIIIw-1; no range site is assigned.

Ar—Arvada loam. This deep, well drained, nearly level soil is on broad flats, in drainageways, and on

alluvial fans. It has a claypan subsoil and some microrelief. A meandering channel dissects some areas. Most areas are long and narrow and are 20 to 300 acres in size.

Typically, the surface layer is light brownish gray loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm, calcareous clay about 22 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has common accumulations of lime and salts. In places shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Kyle and Swanboy soils and Slickspots. These inclusions make up less than 10 percent of any one mapped area. Kyle and Swanboy soils do not have a sodium affected subsoil. They are in positions on the landscape similar to those of the Arvada soils. The Slickspots are nearly bare and are in scattered small depressions.

Fertility and the content of organic matter are low in the Arvada soil. Tilth is poor. The sodium affected subsoil adversely affects root growth. Available water capacity is moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is range. This soil is poorly suited to native grasses because of the dense claypan subsoil near the surface. The native vegetation dominantly is blue grama, western wheatgrass, and buffalograss. Overused areas are dominated by blue grama, buffalograss, saltgrass, and weeds. Restricting use during wet periods helps to prevent surface compaction and deterioration of the plant community.

This soil generally is not suited to cultivated crops or to tame pasture and hay and windbreaks and environmental plantings. The dense claypan subsoil near the surface is the main limitation.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. It generally is unsuited to septic tank absorption fields because of restricted permeability. It is suitable, however, as a site for sewage lagoons.

The capability unit is VIs-3; Thin Claypan range site.

AsB—Ascalon fine sandy loam, 0 to 6 percent slopes. This deep, well drained, nearly level and gently sloping soil is on uplands. Areas are irregular in shape and 15 to 800 acres in size. Slopes are smooth.

Typically, the surface layer is brown fine sandy loam about 3 inches thick. The subsoil is about 24 inches of brown, yellowish brown, and pale brown, very friable fine sandy loam and sandy clay loam. The underlying material to a depth of 60 inches is light gray, calcareous fine sandy loam. In some areas the subsoil contains less clay. In other areas it contains less sand and more silt and clay.

Included with this soil in mapping are small areas of Dailey soils, which generally are on the higher, steeper parts of the landscape. These soils make up less than 10 percent of any one mapped area. They contain more sand and less clay throughout than the Ascalon soil.

Fertility is medium and the content of organic matter moderate in the Ascalon soil. Available water capacity and permeability also are moderate. Runoff is medium.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is prairie sandreed, little bluestem, and needleandthread. Overused areas are dominated by blue grama, needleandthread, sedges, and western wheatgrass.

Unless irrigated, this soil is poorly suited to cultivated crops. Some areas are irrigated. Measures that control wind erosion and conserve moisture are the main management needs. Examples are stripcropping, leaving crop residue on the surface, minimizing tillage, establishing field windbreaks, and including grasses and legumes in the cropping system.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Keeping crop residue on the surface during site preparation helps to control wind erosion until the trees and shrubs are established.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. Septic tank absorption fields function well in this soil.

The capability unit is IVe-7; Sandy range site.

AsC—Ascalon fine sandy loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 10 to 80 acres in size. Slopes are smooth.

Typically, the surface layer is brown fine sandy loam about 3 inches thick. The subsoil is about 24 inches of brown, yellowish brown, and pale brown, very friable fine sandy loam and sandy clay loam. The underlying material to a depth of 60 inches is light gray, calcareous fine sandy loam. In some areas the subsoil contains less clay. In other areas it contains less sand and more silt and clay.

Included with this soil in mapping are small areas of Dailey soils, which generally are on the higher, steeper parts of the landscape. These soils make up less than 10 percent of any one mapped area. They contain more sand and less clay throughout than the Ascalon soil.

Fertility is medium and the content of organic matter moderate in the Ascalon soil. Available water capacity and permeability also are moderate. Runoff is medium.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is little bluestem, prairie sandreed, and needleandthread. Overused areas are dominated by blue grama, needleandthread, sedges, and western wheatgrass.

This soil is poorly suited to cultivated crops. Measures that control erosion and conserve moisture are the main management needs. Examples are minimizing tillage,

leaving crop residue on the surface, establishing field windbreaks, and including grasses and legumes in the cropping system. Contour stripcropping and terracing also help to control erosion.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Keeping crop residue on the surface during site preparation helps to control wind erosion until the trees and shrubs are established. Planting on the contour helps to control water erosion.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. Land shaping is needed on some building sites. Septic tank absorption fields function well in this soil.

The capability unit is IVe-7; Sandy range site.

Ba—Badland. This map unit consists mainly of eroding exposures of siltstone and shale around the head of drainageways on the sides of ridges and buttes. Slopes range from nearly level on the butte tops to very steep on the sides of entrenched drainageways. Vertical walls or escarpments several hundred feet high are common. Deep, narrow gullies are on the lower parts of the landscape. Areas are irregular in shape and 15 to 120 acres in size.

Included with the Badland in mapping are small areas of Epping, Orella, Samsil, and Schamber soils. These soils make up about 10 to 25 percent of any one mapped area. The silty Epping soils are shallow over siltstone bedrock. They are in an intermediate position on the landscape. The clayey Orella and Samsil soils are shallow over shale. They are on the lower parts of the landscape. The gravelly Schamber soils are on the higher parts of the landscape.

Nearly all areas are used as wildlife habitat. These areas generally are scenic. They provide excellent opportunities for sightseeing and hiking. Some of the included soils are used for grazing. Many of these soils, however, are in isolated areas that are inaccessible to livestock.

This map unit generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. It is unsuitable as a site for buildings and septic tank absorption fields because of the slope, a limited depth to bedrock, and restricted permeability.

The capability unit is VIIIs-2; no range site is assigned.

Bb—Bankard fine sandy loam. This deep, somewhat excessively drained, nearly level soil is on flood plains (fig. 6). It is occasionally flooded for brief periods. Areas are oblong and 10 to 130 acres in size.

Typically, the surface layer is light brownish gray, calcareous fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous loamy sand stratified with thin lenses of sandy loam and sand. In some areas adjacent to the stream channel, the soil contains very coarse sand and gravel throughout. In places it is hummocky.

Included with this soil in mapping are small areas of Glenberg and Haverson soils. These soils make up less than 10 percent of any one mapped area. They contain less sand between depths of 10 and 40 inches than the Bankard soil. Also, they are farther from the channels.

Fertility and the content of organic matter are low in the Bankard soil. Available water capacity also is low. Permeability is rapid. Runoff is slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is sand bluestem, prairie sandreed, switchgrass, sand dropseed, sand sagebrush, and blue grama. Some areas support many cottonwoods and willows. Overused areas are dominated by sand dropseed and blue grama. After continued overuse, some areas are bare and blowouts are common.

This soil generally is unsuited to cultivated crops because it is droughty and infertile. It is poorly suited to windbreaks and environmental plantings. Only evergreens and shrubs can be successfully grown. Planting the trees and shrubs directly in sod helps to control wind erosion.

Because of the flooding, this soil generally is unsuitable as a site for buildings and sanitary facilities.

The capability unit is VIe-8; Sands range site.

Bc—Barnum silt loam. This deep, well drained, nearly level soil is on flood plains and low terraces along streams and drainageways. It is occasionally flooded for brief periods. Deep drainage channels dissect all areas, except for some of those on terraces. Areas are long and narrow and 10 to 150 acres in size.

Typically, the surface layer is reddish yellow, calcareous silt loam about 5 inches thick. The underlying material to a depth of 60 inches is reddish yellow, calcareous silt loam stratified with fine sandy loam and very fine sandy loam. In some places the soil contains more sand. In other places it is not so red. In some areas it is not flooded.

Included with this soil in mapping are small areas of Tilford soils on the higher terraces. These soils make up less than 10 percent of any one mapped area. They contain less sand throughout than the Barnum soil and are not stratified.

Fertility and the content of organic matter are low in the Barnum soil. Available water capacity is high. Permeability is moderate. Runoff is slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is big bluestem, western wheatgrass, little bluestem, and blue grama. A few trees and shrubs grow along the channels. Overused areas are dominated by Kentucky bluegrass, blue grama, buffalograss, and weeds.

Figure 6.—An area of Bankard fine sandy loam adjacent to a stream.

This soil generally is not suited to cultivated crops because the meandering channels have dissected the landscape into many areas that are inaccessible or are too small for farming. The areas that are not dissected by the channels are cultivated. Tame hay is grown in some areas.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees grow well.

Because of the flooding, this soil generally is not suited to building site development and sanitary facilities. The higher areas that are not subject to flooding, however, are well suited to building site development and septic tank absorption fields.

The capability unit is VIw-1; Loamy Terrace range site.

BoA—Boneek silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 20 to 80 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil is brown, firm silty clay loam about 17 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous loam. Accumulations of lime are in the lower part of the subsoil and the upper part of the underlying material. In some areas the soil is redder. In other areas the subsoil contains more sand.

Fertility is medium and the content of organic matter moderate. Available water capacity is high. Permeability

is moderately slow. Runoff is slow. The shrink-swell potential is moderate.

About half of the acreage is cropland. This soil is fairly well suited to cultivated crops. It is suitable for irrigation. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, green needlegrass, and needleandthread. Overused areas are dominated by blue grama and sedges.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil is only fairly well suited to building site development because of the moderate shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is only fairly well suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIc-1; Silty range site.

BoB—Boneek silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil is brown, firm silty clay loam about 17 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous loam. Accumulations of lime are in the lower part of the subsoil and the upper part of the underlying material. In some areas the subsoil contains more sand. In other areas it contains more silt and less clay. In places the soil is redder.

Included with this soil in mapping are small areas of Butche soils on ridges and the sides of drainageways. These soils make up less than 10 percent of any one mapped area. They have bedrock within a depth of 20 inches.

Fertility is medium and the content of organic matter moderate in the Boneek soil. Available water capacity is high. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, blue grama, needleandthread, and green needlegrass. Overused areas are dominated by blue grama and sedges.

This soil is fairly well suited to cultivated crops. Measures that control erosion and conserve moisture are the main management needs. Examples are farming on the contour, leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant moisture supply. Planting on the contour helps to control erosion.

This soil is only fairly well suited to building site development because of the moderate shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is only fairly well suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIe-1; Silty range site.

BpB—Boneek silt loam, bedrock substratum, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to 420 acres in size. Slopes are smooth.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil is firm silty clay loam about 13 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material is pale brown and very pale brown, calcareous clay loam about 21 inches thick. Sandstone is below a depth of about 41 inches. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Butche and Paunsaugunt soils on ridges. These soils make up less than 10 percent of any one mapped area. They have bedrock within a depth of 20 inches.

Fertility is medium and the content of organic matter moderate in the Boneek soil. Available water capacity is moderate. Permeability is moderately slow above the bedrock. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, blue grama, needleandthread, and green needlegrass. Overused areas are dominated by blue grama and sedges.

This soil is fairly well suited to cultivated crops. Measures that control erosion and conserve moisture are the main management needs. Examples are farming on the contour, terracing, minimizing tillage, and including grasses and legumes in the cropping system.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

This soil is only fairly well suited to building site development because of the moderate shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is only fairly well suited to septic tank absorption fields because of the restricted permeability and the bedrock within a depth of 60 inches. Enlarging the absorption area helps to overcome these limitations.

The capability unit is IIIe-1; Silty range site.

BrD—Broadhurst clay, 2 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on alluvial fans and terraces. Areas are irregular in shape and 15 to 180 acres in size. Slopes are short. Deep gullies are in many areas.

Typically, the surface layer is grayish brown clay about 4 inches thick. The underlying material to a depth of 60 inches is grayish brown and light brownish gray, very firm clay. In some areas salts are within 15 inches of the surface. In other areas the soil is not so dense.

Fertility and the content of organic matter are low. Tilth is very poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is medium or rapid. The shrink-swell potential is very high. When dry, the soil has many cracks 1/2 inch to 2 inches wide throughout. It is very strongly acid in the surface layer and extremely acid in the lower part of the underlying material.

Although all of the acreage is range, this soil is poorly suited to native grasses. The native vegetation dominantly is western wheatgrass and green needlegrass. Overused areas are dominated by a sparse stand of western wheatgrass and annuals.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. The main limitation is the very poor tilth caused by the high content of clay and the low content of organic matter.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable as a site for sewage lagoons, but land shaping is needed in the steeper areas.

The capability unit is VIs-6; Dense Clay range site.

BuB—Bufton silty clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 15 to 150 acres in size. Slopes are short and smooth.

Typically, the surface layer is light brownish gray silty clay loam about 3 inches thick. The subsoil is light brownish gray and light gray, firm, calcareous silty clay loam about 21 inches thick. The underlying material to a depth of 60 inches is very pale brown, calcareous silty clay loam.

Included with this soil in mapping are small areas of Orella soils on the higher parts of the landscape. These soils make up less than 10 percent of any one mapped area. They are 10 to 20 inches deep over shale.

Fertility and the content of organic matter are low in the Bufton soil. Available water capacity is moderate. Permeability is slow. Runoff is medium. The shrink-swell potential is high.

All of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, blue grama, and green needlegrass. Overused areas are dominated by blue grama and buffalograss.

This soil is poorly suited to cultivated crops. Controlling erosion, improving fertility, and increasing the content of organic matter are the main management concerns. Leaving crop residue on the surface and including grasses and legumes in the cropping system improve fertility and increase the content of organic matter. Farming on the contour, terracing, and minimizing tillage help to control erosion.

This soil is only fairly well suited to windbreaks and environmental plantings. Most of the climatically suited trees and shrubs can be established, but optimum growth, survival, and vigor are unlikely. Planting on the contour helps to control erosion and conserves moisture.

This soil is poorly suited to building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. These fields generally do not function properly unless they are greatly enlarged. Sewage lagoons are a suitable alternative, but land shaping is needed in the steeper areas.

The capability unit is IVe-3; Clayey range site.

BvD—Butche-Boneek complex, 3 to 15 percent slopes. These well drained, gently sloping to strongly sloping soils are on uplands. The shallow Butche soil is on the higher, steeper parts of the landscape. It generally has a few scattered stones on the surface. The deep Boneek soil is on the lower parts of the landscape. Areas are irregular in shape and 20 to 350 acres in size. They are 55 to 70 percent Butche soil and 15 to 35 percent Boneek soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Butche soil is brown fine sandy loam about 4 inches thick. The underlying material is light yellowish brown channery fine sandy

loam about 5 inches thick. Very pale brown hard sandstone is at a depth of about 9 inches. In some areas lime is at or near the surface. In other areas the soil contains more clay throughout.

Typically, the surface layer of the Boneek soil is brown silt loam about 7 inches thick. The subsoil is firm silty clay loam about 13 inches thick. It is brown in the upper part and pale brown and calcareous in the lower part. The underlying material is very pale brown, calcareous clay loam about 21 inches thick. Sandstone is at a depth of about 41 inches. In some areas the subsoil contains more sand. In other areas the soil is not so brown.

Included with these soils in mapping are small areas of Mathias soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The deep Mathias soils have many rocks and boulders throughout and contain less clay in the subsoil than the Boneek soil. They are on the steeper south- and west-facing slopes. The Rock outcrop is on the higher, steeper parts of the landscape.

Fertility and the content of organic matter are low in the Butche soil. Fertility is medium and the content of organic matter moderate in the Boneek soil. Available water capacity is very low and permeability moderate in the Butche soil. Available water capacity is high and permeability moderately slow in the Boneek soil. Runoff is medium on both soils.

All areas support native grasses and are used for grazing. This map unit is fairly well suited to range. The native vegetation on the Butche soil dominantly is little bluestem, prairie sandreed, needleandthread, and western wheatgrass. That on the Boneek soil dominantly is western wheatgrass, green needlegrass, needleandthread, and blue grama. Overused areas are dominated by blue grama and sedges.

This map unit is generally unsuited to cultivated crops because the Butche soil is too shallow. The Boneek soil is better suited than the Butche soil, but it cannot be farmed separately because it occurs as areas too closely intermingled with areas of the Butche soil. The Boneek soil also is better suited to windbreaks and environmental plantings. Trees and shrubs grow well on the Boneek soil, but optimum growth and survival are unlikely on the Butche soil. Planting on the contour helps to control erosion and conserves moisture.

Because it is shallow over bedrock, the Butche soil generally is unsuited to building site development and septic tank absorption fields. The Boneek soil is only fairly well suited to building site development because of the moderate shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The Boneek soil is only fairly well suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The Butche soil is in capability unit VIs-2, Shallow range site; the Boneek soil is in capability unit IVe-1, Silty range site.

CnD—Colby-Norka silt loams, 6 to 15 percent slopes. These deep, well drained, moderately sloping and strongly sloping soils are in slightly convex areas on uplands. The strongly sloping Colby soil is on the higher, steeper ridgetops. The moderately sloping Norka soil is on side slopes. Areas are irregular in shape and 15 to 280 acres in size. They are 40 to 60 percent Colby soil and 30 to 45 percent Norka soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Colby soil is brown, calcareous silt loam about 4 inches thick. Below this is a transition layer of pale brown, calcareous silt loam about 3 inches thick. The upper part of the underlying material is very pale brown, calcareous silt loam. The lower part to a depth of 60 inches is pale brown, calcareous loam. In places the soil contains less clay throughout.

Typically, the surface layer of the Norka soil is brown silt loam about 4 inches thick. The subsoil is about 11 inches thick. It is brown, very friable silt loam in the upper part; grayish brown, friable silty clay loam in the next part; and light gray, very friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray silt loam. In places siltstone bedrock is 20 to 40 inches from the surface.

Included with these soils in mapping are small areas of Ascalon soils. These included soils make up less than 15 percent of any one mapped area. They contain more sand in the subsoil than the Colby and Norka soils. They are in positions on the landscape similar to those of the Colby and Norka soils.

Fertility and the content of organic matter are low in the Colby soil. Fertility is medium and the content of organic matter moderate in the Norka soil. Available water capacity is high in both soils. Permeability is moderate. Runoff is medium.

About half of the acreage is range. The Colby soil is fairly well suited and the Norka soil well suited to native grasses. The native vegetation on the Colby soil dominantly is blue grama, needlegrasses, little bluestem, sideoats grama, and western wheatgrass. That on the Norka soil dominantly is western wheatgrass, blue grama, and green needlegrass. Overused areas are dominated by needleandthread, sedges, and blue grama.

This map unit is generally unsuited to cultivated crops because the Colby soil is strongly sloping and calcareous. The Norka soil is better suited, but it cannot be farmed separately because it occurs as areas too closely intermingled with areas of the Colby soil. The Norka soil also is better suited to windbreaks and environmental plantings. Trees and shrubs grow well on

the Norka soil, but optimum growth and survival are unlikely on the Colby soil. Planting on the contour helps to control erosion and conserves moisture.

The Norka soil is well suited to most kinds of building site development. The Colby soil is less well suited because it is steeper. Extensive land leveling is needed. Both soils are only fairly well suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The Colby soil is in capability unit VIe-3, Thin Upland range site; the Norka soil is in capability unit IVe-1, Silty range site.

DaB—Dailey fine sand, 0 to 6 percent slopes. This deep, somewhat excessively drained, nearly level and gently sloping soil is on uplands. Areas are irregular in shape and 15 to 900 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown fine sand about 9 inches thick. The subsurface layer is brown fine sand about 5 inches thick. The underlying material to a depth of 60 inches is fine sand. It is grayish brown in the upper part and pale brown in the lower part. In places the surface layer is not so dark. In some areas the dark colors extend to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Ascalon and Jayem soils. These soils make up less than 10 percent of any one mapped area. Ascalon soils contain more clay in the subsoil than the Dailey soil, and Jayem soils contain less sand in the subsoil. Both soils are in positions on the landscape similar to those of the Dailey soil.

Fertility and the content of organic matter are low in the Dailey soil. Available water capacity also is low. Permeability is rapid. Runoff is slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is little bluestem, prairie sandreed, sand bluestem, blue grama, and needlegrass. Overused areas are dominated by blue grama and sand dropseed. After continued overuse, bare areas are common and blowouts form in places.

This soil generally is unsuited to cultivated crops because it is droughty, very sandy, and infertile. The abrasive action of blowing sand destroys seedlings before they are established.

This soil is poorly suited to windbreaks and environmental plantings. Only evergreens and shrubs can be successfully established. Planting the trees and shrubs directly in sod helps to control wind erosion.

This soil is well suited to building site development, but the sides of shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water.

The capability unit is VIe-10; Sands range site.

DaC—Dailey fine sand, 6 to 12 percent slopes. This deep, somewhat excessively drained, moderately sloping and strongly sloping soil is on uplands. Areas are irregular in shape and 15 to 340 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown fine sand about 9 inches thick. The subsurface layer is brown fine sand about 5 inches thick. The underlying material to a depth of 60 inches is fine sand. It is grayish brown in the upper part and pale brown in the lower part. In places the surface layer is not so dark.

Included with this soil in mapping are small areas of Ascalon and Jayem soils. These soils make up less than 10 percent of any one mapped area. Ascalon soils contain more clay in the subsoil than the Dailey soil. They are in positions on the landscape similar to those of the Dailey soil. Jayem soils contain less sand in the subsoil than the Dailey soil. They are on the lower, less sloping parts of the landscape.

Fertility and the content of organic matter are low in the Dailey soil. Available water capacity also is low. Permeability is rapid. Runoff is slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is little bluestem, prairie sandreed, sand bluestem, blue grama, and needlegrass. Overused areas are dominated by blue grama and sand dropseed. After continued overuse, bare areas are common and blowouts form in places.

This soil generally is unsuited to cultivated crops because it is droughty, very sandy, and infertile. The abrasive action of blowing sand destroys seedlings before they are established.

This soil is poorly suited to windbreaks and environmental plantings. Only evergreens and shrubs can be successfully established. Planting the trees and shrubs directly in sod helps to control wind erosion.

This soil is only fairly well suited to building site development because of the slope. Land shaping is needed in most areas. Because the cut areas are very sandy, revegetating is difficult. The buildings should be designed to conform to the natural slope of the land. Shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water.

The capability unit is VIe-10; Sands range site.

DwA—Dwyer loamy fine sand, 0 to 2 percent slopes. This deep, somewhat excessively drained, nearly level soil is on broad terraces and uplands. Areas are irregular in shape and 20 to 250 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray loamy fine sand about 6 inches thick. The underlying material

to a depth of 60 inches is pale brown, calcareous loamy fine sand. In some areas the soil is dark to a depth of more than 20 inches. In places lime is leached to a depth of more than 40 inches.

Included with this soil in mapping are small areas of Alice soils. These soils make up less than 10 percent of any one mapped area. They contain less sand throughout than the Dwyer soil and have a thicker, darker surface layer.

Fertility and the content of organic matter are low in the Dwyer soil. Available water capacity also is low. Permeability is rapid. Runoff is very slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is needleandthread, prairie sandreed, blue grama, and western wheatgrass. Overused areas are dominated by blue grama, sand dropseed, and sedges. After continued overuse, bare areas are common and blowouts form in places.

This soil is poorly suited to cultivated crops. Measures that control wind erosion and conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, including grasses and legumes in the cropping system, stripcropping, and planting field windbreaks.

This soil is poorly suited to windbreaks and environmental plantings. Only evergreens and shrubs can be successfully established. Planting the trees and shrubs directly in sod helps to control wind erosion.

This soil is well suited to building site development, but the sides of shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water.

The capability unit is IVe-4; Sandy range site.

DwB—Dwyer loamy fine sand, 2 to 6 percent slopes. This deep, somewhat excessively drained, gently sloping soil is on uplands. Areas are irregular in shape and 20 to 200 acres in size. Slopes generally are long and smooth. In some areas, however, the surface is hummocky. In places it is uneven because it is eroded.

Typically, the surface layer is light brownish gray loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous loamy fine sand. In places lime is leached to a depth of more than 40 inches. In some areas slopes are as much as 9 percent.

Included with this soil in mapping are small areas of Alice and Ascalon soils. These soils make up less than 10 percent of any one mapped area. They contain less sand throughout than the Dwyer soil and have a thicker, darker surface layer. They are in positions on the landscape similar to those of the Dwyer soil.

Fertility and the content of organic matter are low in the Dwyer soil. Available water capacity also is low. Permeability is rapid. Runoff is very slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is needleandthread, prairie sandreed, blue grama, and western wheatgrass. Overused areas are dominated by blue grama, sand dropseed, and sedges. After continued overuse, bare areas are common and blowouts form in places.

This soil generally is unsuited to cultivated crops because it is droughty, sandy, and infertile. Also, it is subject to severe wind erosion if cropped.

This soil is poorly suited to windbreaks and environmental plantings. Only evergreens and shrubs can be successfully established. Planting the trees and shrubs directly in sod helps to control wind erosion.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water.

The capability unit is VIe-9; Sandy range site.

DwE—Dwyer loamy fine sand, 6 to 25 percent slopes. This deep, somewhat excessively drained, moderately sloping to moderately steep soil is on uplands. Areas are irregular in shape and 20 to 280 acres in size. Slopes are short and rough or broken. They generally are dissected by gullies and drainageways.

Typically, the surface layer is light brownish gray loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous loamy fine sand. In places lime is leached to a depth of more than 40 inches.

Fertility and the content of organic matter are low. Available water capacity also is low. Permeability is rapid. Runoff is very slow.

All of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is needleandthread, prairie sandreed, blue grama, and western wheatgrass. Overused areas are dominated by blue grama, sand dropseed, and sedges. After continued overuse, bare areas are common and blowouts form in places.

This soil is generally unsuited to cultivated crops and windbreaks and environmental plantings. It generally is too steep and is too erosive.

This soil is poorly suited to building site development because of the slope. The less sloping areas should be selected as building sites. The sides of shallow excavations tend to cave in unless they are shored. The soil generally is too steep for septic tank absorption fields to function properly. In the less sloping areas, it

readily absorbs but does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water.

The capability unit is VIIe-3; Sandy range site.

EaC—Eckley loam, 0 to 9 percent slopes. This well drained, nearly level to gently sloping soil is on terraces. Areas are irregular in shape and 10 to 125 acres in size. Slopes are short and smooth.

Typically, the surface layer is grayish brown loam about 4 inches thick. The subsoil is brown, friable clay loam about 8 inches thick. The underlying material to a depth of 60 inches is brown, calcareous gravelly sand. In some areas the gravelly sand is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Pierre, Schamber, and Zigweid soils. These soils make up less than 10 percent of any one mapped area. Pierre soils contain more clay in the subsoil than the Eckley soil and are underlain by shale. Their position on the landscape is similar to that of the Eckley soil. Schamber soils have a thinner, lighter colored surface layer and contain less silt and clay throughout than the Eckley soil. Also, they are slightly higher on the landscape. Zigweid soils are not underlain by gravelly sand. They are in positions on the landscape similar to those of the Eckley soil.

Fertility is medium and the content of organic matter moderate in the Eckley soil. Available water capacity is low. Permeability is moderate in the subsoil and rapid in the underlying material. Runoff is medium.

Most of the acreage is range. This soil is poorly suited to native grasses, however, because it is droughty. The native vegetation dominantly is blue grama, western wheatgrass, needleandthread, and sedges. Overused areas are dominated by blue grama, needleandthread, and sedges.

This soil generally is unsuited to cultivated crops and poorly suited to windbreaks and environmental plantings because it is droughty.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. The soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water.

The capability unit is VIs-4; Shallow to Gravel range site.

Ga—Glenberg fine sandy loam. This deep, well drained, nearly level, calcareous soil is on low terraces and flood plains. It is subject to rare flooding for very brief periods. Areas are irregular in shape and 10 to 350 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray, calcareous fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous fine sandy loam stratified with thin layers of very fine sandy loam, silt loam, and gravelly sandy loam. In some areas slopes are as much as 7 percent. In places the soil contains more clay and less sand.

Included with this soil in mapping are small areas of Bankard soils. These soils make up less than 10 percent of any one mapped area. They contain more sand between depths of 10 and 40 inches than the Glenberg soil. Also, they are nearer the stream channel.

Fertility and the content of organic matter are low in the Glenberg soil. Available water capacity also is low. Permeability is moderately rapid. Runoff is slow.

About half of the acreage is range. This soil is well suited to native grasses. Cottonwoods in some of the lower areas provide protection for livestock and wildlife. The native vegetation dominantly is sand bluestem, little bluestem, and prairie sandreed. Overused areas are dominated by sand dropseed, needleandthread, blue grama, and western wheatgrass.

Unless irrigated, this soil is poorly suited to cultivated crops. Most of the cultivated areas are irrigated. Corn, small grain, and alfalfa are the main crops. The high content of lime in the surface layer adversely affects the availability of plant nutrients. In some years the soil is flooded, but damage generally is minor. Measures that control wind erosion, conserve moisture, increase the content of organic matter, and improve fertility are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

Because of the flooding, this soil generally is unsuitable as a site for buildings and sanitary facilities.

The capability unit is IVe-6; Loamy Terrace range site.

GrE—Grummit-Rock outcrop complex, 3 to 40 percent slopes. This map unit occurs as areas of a shallow, well drained, gently sloping to steep Grummit soil closely intermingled with areas of Rock outcrop. It is on uplands that generally are dissected by gullies. The Grummit soil is on the less sloping parts of the landscape. Areas are irregular in shape and 15 to 80 acres in size. They are 55 to 75 percent Grummit soil and 20 to 40 percent Rock outcrop. The Grummit soil and Rock outcrop occur as areas so intermingled that mapping them separately is not practical.

Typically, the surface layer of the Grummit soil is light brownish gray, very strongly acid clay about 4 inches thick. The underlying material is grayish brown, extremely acid shaly clay about 7 inches thick. Light gray, extremely acid shale is at a depth of about 11 inches. In some areas the shale is more than 20 inches from the surface. In other areas the soil is calcareous throughout.

The Rock outcrop is soft, light gray, extremely acid shale.

Included with the Grummit soil and Rock outcrop in mapping are small areas of Broadhurst and Snomo soils. These included soils make up less than 10 percent of any one mapped area. Broadhurst soils are gently sloping to strongly sloping and are on fans and terraces. They have a dense subsoil and are more than 40 inches deep over shale. Snomo soils also are more than 40 inches deep over shale. They are in the lower, flatter areas.

Fertility and the content of organic matter are low in the Grummit soil. Available water capacity is very low. Permeability is moderate. Runoff is medium. The shrink-swell potential is high.

All of the acreage is range. The Grummit soil is fairly well suited to native grasses. The Rock outcrop supports little or no vegetation (fig. 7). The native vegetation on the Grummit soil dominantly is little bluestem, western wheatgrass, sideoats grama, and blue grama. A sparse stand of stunted ponderosa pine grows in some areas. Overused areas are dominated by blue grama and sedges. After continued overuse, the grasses are sparse and annuals and bare areas are more extensive.

This map unit is generally unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because of the limited depth to shale and the slope.

The Grummit soil is in capability unit VIIe-5, Shallow Clay range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

GsD—Grummit-Snomo clays, 3 to 15 percent slopes. These well drained, gently sloping to strongly sloping soils are in areas on uplands where slopes are long and are rough or broken. The shallow Grummit soil is on the more sloping parts of the landscape. The deep Snomo soil is on the lower, less sloping parts. The more sloping areas commonly are dissected by deep, steep-walled gullies and short canyons. Areas are irregular in shape and 15 to 130 acres in size. They are about 50 to

Figure 7.—Sparse vegetation in an area of Grummit-Rock outcrop complex, 3 to 40 percent slopes.

65 percent Grummit soil and 20 to 30 percent Snomo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Grummit soil is light brownish gray, very strongly acid clay about 4 inches thick. The underlying material is grayish brown, extremely acid shaly clay about 7 inches thick. Light gray, extremely acid shale is at a depth of about 11 inches. In some areas the shale is more than 20 inches from the surface. In other areas the soil is calcareous throughout.

Typically, the surface layer of the Snomo soil is light brownish gray clay about 7 inches thick. The subsoil is pale brown, friable clay about 31 inches thick. The upper part of the underlying material is pale brown clay. The lower part to a depth of 60 inches is light brownish gray shaly clay. In places shale is within a depth of 40 inches. In some areas the soil is calcareous throughout and is 20 to 40 inches deep over shale.

Included with these soils in mapping are small areas of Broadhurst soils and Rock outcrop. The included soils and Rock outcrop make up less than 15 percent of any one mapped area. Broadhurst soils have a dense subsoil. The Rock outcrop is shale bedrock on ridgetops and steep slopes.

Fertility and the content of organic matter are low in the Grummit soil. Fertility is low and the content of organic matter moderate in the Snomo soil. Available water capacity is very low in the Grummit soil and low in the Snomo soil. Permeability is moderate in both soils. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is range. These soils are fairly well suited to native grasses. The native vegetation dominantly is little bluestem, western wheatgrass, sedges, and sideoats grama. A sparse stand of ponderosa pine and bur oak grows in most areas. Overused areas are dominated by blue grama and sedges.

These soils generally are too steep and too shallow for cultivated crops and windbreaks and environmental plantings. Also, the extreme acidity adversely affects the availability of plant nutrients.

These soils are poorly suited to most kinds of building site development. The high shrink-swell potential is the main limitation. The shallowness to shale in the Grummit soil is an additional limitation. The Grummit soil generally is unsuited to septic tank absorption fields because it is shallow over bedrock. The Snomo soil is only fairly well suited because of the restricted permeability and the slope.

The Grummit soil is in capability unit VIe-12, Shallow Clay range site; the Snomo soil is in capability unit VIe-4, Clay Savannah range site.

Ha—Haverson loam. This deep, well drained, nearly level soil is on flood plains. It is subject to rare flooding. Many areas are dissected by meandering channels. Areas are oblong or long and narrow and are 10 to 190 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The underlying material to a depth of 60 inches is grayish brown, calcareous, stratified loam, clay loam, silt loam, fine sandy loam, loamy fine sand, and loamy sand. In places the soil is redder. In some areas it contains less clay between depths of 10 and 40 inches.

Included with this soil in mapping are small areas of Kyle and Lohmiller soils. These soils make up less than 10 percent of any one mapped area. Kyle soils are not stratified and contain more clay throughout than the Haverson soil. They are near the uplands. Lohmiller soils contain more clay between depths of 10 and 40 inches than the Haverson soil. They are on the lower parts of the flood plain.

Fertility and the content of organic matter are low in the Haverson soil. Available water capacity is high. Permeability is moderate. Runoff is slow.

About half of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama, sedges, and needleandthread.

This soil is fairly well suited to cultivated crops in areas that are not dissected by channels. Some areas are irrigated. Alfalfa and small grain are the main crops. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Measures that conserve moisture, improve fertility, increase the content of organic matter, and control wind erosion are the main management needs. Examples are minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

Because of the flooding, this soil generally is unsuitable as a site for buildings and sanitary facilities.

The capability unit is IIIc-2; Loamy Terrace range site.

HbB—Haverson Variant loam, 3 to 9 percent slopes. This deep, well drained, gently undulating to gently rolling soil is on the foot slopes of steep rocky hills and mountains. It is subject to rare flooding. Areas commonly are dissected by deep gullies and channels. They are long and narrow and 25 to 70 acres in size. Slopes are short and are rough or broken.

Typically, the surface layer is dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown, calcareous gravelly loam about 3 inches thick. The underlying material to a depth of 60 inches is reddish brown, calcareous, stratified gravelly sandy loam and loam.

Included with this soil in mapping are small areas of Barnum and Nevee soils. These soils make up less than

10 percent of any one mapped area. Barnum soils have fewer coarse fragments between depths of 10 and 40 inches than the Haverson Variant soil. They are on low terraces and flood plains. Nevee soils contain less gravel and sand between depths of 10 and 40 inches than the Haverson Variant soil. They are on low terraces adjacent to the stream channel.

Fertility and the content of organic matter are low in the Haverson Variant soil. Available water capacity and permeability are moderate. Runoff is slow.

Nearly all of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, and needleandthread. Overused areas are dominated by blue grama and sedges.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings because it is droughty. It is only fairly well suited to most kinds of building site development and septic tank absorption fields because of the flooding.

The capability unit is VIe-5; Loamy Terrace range site.

He—Hisle-Slickspots complex. This map unit occurs as areas of a moderately deep, well drained, nearly level and gently sloping Hisle soil intermingled with Slickspots. It is on uplands and terraces. The Hisle soil is on slight mounds, and the Slickspots are in depressions (fig. 8). Some areas are dissected by steep-walled gullies. Areas generally are long and narrow and 15 to 450 acres in size. They are about 60 to 75 percent Hisle soil and 20 to 35 percent Slickspots. The Hisle soil and Slickspots occur as areas so closely intermingled that mapping them separately is not practical.

Typically, the surface layer of the Hisle soil is light gray silt loam about 1 inch thick. The subsoil is pale olive, firm, calcareous clay about 15 inches thick. The underlying material is about 13 inches of pale olive and light olive gray, firm, calcareous clay and shaly clay. Accumulations of salts are throughout the subsoil and

Figure 8.—An area of Hisle-Slickspots complex. The Hisle soil supports vegetation.

underlying material. Gray shale is at a depth of about 29 inches. In some areas it is below a depth of 40 inches.

The surface of the Slickspots is so crusted that it is nearly impervious to water. Visible accumulations of salts are at or near the surface. The soil material to a depth of 60 inches is dense, massive clay.

Included with the Hisle soil and the Slickspots in mapping are small areas of Kyle soils. These included soils make up less than 10 percent of any one mapped area. They are on the higher parts of the landscape. Their subsoil has a lower content of salts than that of the Hisle soil and is not sodium affected.

Fertility and the content of organic matter are low in the Hisle soil. Tilth is poor. The sodium affected subsoil adversely affects root growth. Available water capacity is low. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

All of the acreage is range. The Hisle soil is poorly suited to native grasses. The native vegetation on this soil dominantly is blue grama, buffalograss, and western wheatgrass. If the range is overused, the extent of buffalograss increases. After continued overuse, pricklypear, saltgrass, and weeds occupy the site. The Slickspots support a sparse stand of annual weeds and cacti during wet periods.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings because of the claypan subsoil, the high content of sodium, and the bare areas.

Because of the very high shrink-swell potential, this map unit is poorly suited to building site development. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The unit generally is unsuitable as a site for septic tank absorption fields because of the very restricted permeability.

The Hisle soil is in capability unit VIs-3, Thin Claypan range site; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site.

Ho—Hoven silt loam. This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are 10 to 50 acres in size and generally are circular.

Typically, the surface layer is grayish brown silt loam about 2 inches thick. The subsoil is dark gray and gray, very firm and firm silty clay about 28 inches thick. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam.

Included with this soil in mapping are small areas of the well drained Absted and Savo soils at the outer edge of the depressions. These soils make up less than 5 percent of any one mapped area. The surface layer of Absted soils is thicker than that of the Hoven soil. Savo soils do not have a sodium affected subsoil.

Fertility is low and the content of organic matter moderate in the Hoven soil. Tilth is poor. Permeability is very slow. Available water capacity is moderate. A seasonal water table is within a depth of 1.5 feet part of the year. As much as 1.0 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grasses. This soil is fairly well suited to range. The native vegetation dominantly is western wheatgrass and sedges. Overused areas are dominated by saltgrass and weeds. Many areas are potential sites for excavated ponds.

Because of the ponding, this soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings and is unsuitable as a site for buildings and most sanitary facilities.

The capability unit is VIs-3; Closed Depression range site.

JaB—Jayem fine sandy loam, 2 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on terraces and uplands. Areas are irregular in shape and 15 to 950 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown fine sandy loam about 6 inches thick. The subsurface layer is dark brown fine sandy loam about 7 inches thick. The subsoil is brown, very friable fine sandy loam about 17 inches thick. The underlying material to a depth of 60 inches is brown loamy fine sand. In some areas lime is 18 to 60 inches from the surface. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Satanta soils. These soils make up less than 10 percent of any one mapped area. They contain more clay in the subsoil than the Jayem soil. Their position on the landscape is similar to that of the Jayem soil.

Fertility is medium and the content of organic matter moderate in the Jayem soil. Available water capacity also is moderate. Permeability is moderately rapid. Runoff is slow.

Most of the acreage is cultivated. Unless irrigated, this soil is poorly suited to cultivated crops. Some areas are irrigated. The main management concern is controlling wind erosion. Conserving moisture and controlling water erosion are other management concerns. Minimizing tillage, including grasses and legumes in the cropping system, contour stripcropping, establishing field windbreaks, and leaving crop residue on the surface help to control wind erosion and conserve moisture.

This soil is well suited to range. The native vegetation dominantly is prairie sandreed, little bluestem, needleandthread, western wheatgrass, and sand bluestem. Overused areas are dominated by blue grama, needleandthread, sedges, and western wheatgrass.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and

shrubs grow well, except for those that require an abundant supply of moisture. Leaving crop residue on the surface during site preparation helps to control wind erosion.

This soil is well suited to building site development, but the sides of shallow excavations tend to cave in unless they are shored. Septic tank absorption fields function well in this soil.

The capability unit is IVe-7; Sandy range site.

KaB—Kadoka silt loam, 0 to 6 percent slopes. This moderately deep, well drained, nearly level and gently sloping soil is on uplands. Areas are irregular in shape and 10 to 70 acres in size. Slopes are short and smooth.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown and pale brown, friable silty clay loam in the upper part and pale brown, calcareous silt loam in the lower part. The underlying material is very pale brown, calcareous silt loam about 15 inches thick. It has a few accumulations of lime. Very pale brown siltstone is at a depth of about 36 inches. In places it is below a depth of 40 inches. In some areas, the subsoil contains more clay and bedrock is below a depth of 40 inches.

Included with this soil in mapping are small areas of Epping soils on the higher, steeper parts of the landscape. These soils make up less than 10 percent of any one mapped area. They are 10 to 20 inches deep over siltstone bedrock.

Fertility is medium and the content of organic matter moderate in the Kadoka soil. Available water capacity and permeability also are moderate. Runoff is medium.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, needleandthread, and blue grama. Overused areas are dominated by needleandthread, blue grama, and sedges.

This soil is fairly well suited to cultivated crops. Measures that control erosion and conserve moisture are the main management needs. Examples are farming on the contour, leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion and conserves moisture.

This soil is only fairly well suited to building site development because of the depth to bedrock. The bedrock is soft and rippable, however, and can be excavated by suitable machinery. The soil generally is unsuited to septic tank absorption fields because bedrock is 20 to 40 inches from the surface.

The capability unit is IIIe-1; Silty range site.

KeD—Kadoka-Epping silt loams, 6 to 15 percent slopes. These well drained soils are on uplands. The moderately deep, gently rolling Kadoka soil is on the lower parts of the landscape. The shallow, rolling Epping soil is on the higher parts. Areas are irregular in shape and range from 10 to 150 acres in size. They are about 50 to 60 percent Kadoka soil and 25 to 35 percent Epping soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Kadoka soil is grayish brown silt loam about 4 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown and pale brown, friable and firm silty clay loam in the upper part and pale brown, friable, calcareous silt loam in the lower part. The underlying material is very pale brown, calcareous silt loam about 15 inches thick. It has a few accumulations of lime. Very pale brown siltstone is at a depth of about 36 inches. In places it is below a depth of 40 inches.

Typically, the surface layer of the Epping soil is light brownish gray, calcareous silt loam about 4 inches thick. Below this is a transition layer of light brownish gray, calcareous silt loam about 7 inches thick. The underlying material is very pale brown, calcareous silt loam about 6 inches thick. It has many siltstone fragments. Very pale brown siltstone is at a depth of about 17 inches.

Included with these soils in mapping are small areas of Orella soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. Orella soils contain more clay throughout than the Kadoka and Epping soils and are 10 to 20 inches deep over shale. They are in positions on the landscape similar to those of the Epping soil. The Rock outcrop is exposed siltstone. It generally is in bare areas on steep escarpments or the sides of gullies.

Fertility is medium and the content of organic matter moderate in the Kadoka soil and low in the Epping soil. Available water capacity is moderate in the Kadoka soil and very low in the Epping soil. Permeability is moderate in both soils. Runoff is rapid.

All of the acreage is range. The Kadoka soil is well suited and the Epping soil fairly well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, needleandthread, and blue grama. The Epping soil also supports sideoats grama and little bluestem. Overused areas are dominated by blue grama and sedges.

This map unit is poorly suited to cultivated crops because of the slope and the shallowness of the Epping soil. The Kadoka soil is better suited, but it cannot be farmed separately because it occurs as areas closely intermingled with areas of the Epping soil. The Kadoka soil is suited to windbreaks and environmental plantings. Planting the trees and shrubs on the contour helps to control erosion and conserves moisture.

The Epping soil is generally unsuited to building site development because it is shallow over bedrock and rolling. The Kadoka soil is better suited, but the depth to bedrock and the slope are limitations. Both soils generally are unsuited to septic tank absorption fields because bedrock is within 40 inches of the surface.

The Kadoka soil is in capability unit IVe-1, Silty range site; the Epping soil is in capability unit VIe-11, Shallow range site.

KyA—Kyle clay, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands and terraces. When dry, it is characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Some areas on the lower parts of long slopes are dissected by deep drainage channels. Areas are irregular in shape and 10 to 210 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown and light olive gray, very firm, calcareous clay about 20 inches thick. The underlying material to a depth of 60 inches is light olive gray and pale olive, calcareous clay having common accumulations of gypsum. In some areas the surface layer is darker. In places shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Hisle, Savo, and Swanboy soils. These soils make up less than 10 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are on the lower parts on the landscape. Savo soils contain less clay in the subsoil than the Kyle soil. They are in positions on the landscape similar to those of the Kyle soil. Swanboy soils are denser than the Kyle soil and have salts within 15 inches of the surface. They are on foot slopes and fans.

Fertility and the content of organic matter are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is only fairly well suited to cultivated crops because it is subject to surface compaction if tilled when wet and cannot be easily tilled when dry. Small grain is the main crop. Improving tilth and conserving moisture are the main management concerns. Controlling wind erosion also is a concern. Minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface conserve moisture, improve tilth, and help to control wind erosion. Stripcropping also helps to control wind erosion.

This soil is only fairly well suited to windbreaks and environmental plantings. Windbreaks can be established, but optimum growth is unlikely.

Because of the very high shrink-swell potential, this soil is poorly suited to most kinds of building site development. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the very restricted permeability, this soil generally is unsuited to septic tank absorption fields. It is suitable, however, as a site for sewage lagoons.

The capability unit is IVs-3; Clayey range site.

KyB—Kyle clay, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and terraces. When dry, it is characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Some areas on the lower parts of long slopes are dissected by deep drainage channels. Areas are irregular in shape and 10 to 450 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown and light olive gray, very firm, calcareous clay about 20 inches thick. The underlying material to a depth of 60 inches is light olive gray and pale olive, calcareous clay having common accumulations of gypsum. In some areas the surface layer is darker. In places shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Hisle and Savo soils. These soils make up less than 10 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are in drainageways and swales. Savo soils contain less clay in the subsoil than the Kyle soil. Their position on the landscape is similar to that of the Kyle soil.

Fertility and the content of organic matter are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is poorly suited to cultivated crops because it is subject to surface compaction if tilled when wet and cannot be easily tilled when dry. Measures that control erosion, improve tilth, and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways also help to control water erosion.

This soil is only fairly well suited to windbreaks and environmental plantings. Windbreaks can be established, but optimum growth is unlikely.

Because of the very high shrink-swell potential, this soil is poorly suited to most kinds of building site development. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the very restricted permeability, this soil generally is unsuited to septic tank absorption fields. It is suitable as a site for sewage lagoons, but land shaping is needed in the steeper areas.

The capability unit is IVe-3; Clayey range site.

Lo—Lohmiller silty clay loam. This deep, well drained, nearly level soil is on flood plains that in some areas are dissected by deep channels. It is subject to rare flooding. Areas are long and narrow and 10 to 1,200 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown silty clay loam about 4 inches thick. The subsurface layer is grayish brown clay loam about 4 inches thick. The underlying material to a depth of about 60 inches is grayish brown, calcareous, stratified clay loam, loam, silty clay loam, and fine sandy loam. In some areas the soil contains more clay between depths of 10 and 40 inches.

Included with this soil in mapping are small areas of Arvada, Haverson, and Kyle soils. These soils make up less than 10 percent of any one mapped area. Arvada soils have a sodium affected subsoil. They occur as areas intermingled with some areas of the Lohmiller soil. Haverson soils contain less clay between depths of 10 and 40 inches than the Lohmiller soil. Also, they are slightly higher on the landscape. Kyle soils are not stratified and contain more clay in the subsoil than the Lohmiller soil. They are on fans near the uplands.

Fertility is low and the content of organic matter moderate in the Lohmiller soil. Tilth is fair. Available water capacity is moderate or high. Permeability is moderately slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is range. This soil is well suited to native grasses. In some areas it receives runoff from adjacent soils. The additional moisture is beneficial. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama and weeds.

This soil is fairly well suited to cultivated crops in areas that are not dissected by channels. Alfalfa is the main crop, but small grain also is grown. Some areas are irrigated. Measures that conserve moisture and improve tilth and fertility are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. The native trees along the channels provide habitat for wildlife and protection for livestock.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding.

The capability unit is IIIc-2; Loamy Terrace range site.

MaA—Manvel silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level, calcareous soil is on foot slopes and fans. Areas are long and narrow and irregularly shaped. They are 10 to 80 acres in size. Slopes are smooth.

Typically, the surface layer is light brownish gray, calcareous silt loam about 5 inches thick. Below this is a transition layer of light gray, calcareous silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches is very pale brown, calcareous silty clay loam. In some areas bedrock is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Manzanola and Norka soils. These soils make up less than 10 percent of any one mapped area. Manzanola soils contain more clay in the subsoil than the Manvel soil. They occur as areas closely intermingled with areas of the Manvel soil. Norka soils are on the higher parts of the landscape. Their surface layer is darker than that of the Manvel soil.

Fertility and the content of organic matter are low in the Manvel soil. Available water capacity is high. Permeability is moderate. Runoff is medium.

Most of the acreage is range. This soil is fairly well suited to native grasses. The native vegetation dominantly is blue grama, green needlegrass, sedges, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

This soil is poorly suited to cultivated crops. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Measures that control wind erosion, improve fertility, and conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system.

This soil is only fairly well suited to windbreaks and environmental plantings because of the high content of lime in the surface layer. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

This soil is well suited to building site development. It is only fairly well suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IVe-10; Thin Upland range site.

MbA—Manzanola silty clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces, fans, and uplands. Areas are irregular in shape and 20 to 450 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray, calcareous silty clay loam about 4 inches thick. The subsoil is about 21 inches thick. It is grayish brown, very friable, calcareous silty clay loam in the upper part and light gray, firm, calcareous silty clay in the lower part. Common accumulations of gypsum are in the lower part of the subsoil and in the underlying material. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam. In some areas shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Kyle, Pierre, and Savo soils. These soils make up less than 10 percent of any one mapped area. Kyle soils contain more clay in the subsoil than the Manzanola soil. They are in the lower positions on the landscape. Pierre soils contain more clay in the subsoil than the Manzanola soil and are 20 to 40 inches deep over shale. They are on the higher, more sloping parts of the landscape. Savo soils are on terraces. Their surface layer is darker than that of the Manzanola soil.

Fertility and the content of organic matter are low in the Manzanola soil. Available water capacity is moderate or high. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is fairly well suited to cultivated crops. Alfalfa and winter wheat are the main crops. Improving fertility and conserving moisture are the main management concerns. Controlling wind erosion also is a concern. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system improve fertility, conserve moisture, and help to control wind erosion. Stripcropping also helps to control wind erosion.

This soil is only fairly well suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum growth is unlikely.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The capability unit is IIIc-1; Clayey range site.

MbB—Manzanola silty clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 20 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray, calcareous silty clay loam about 4 inches thick. The subsoil is about 21 inches thick. It is grayish brown, very friable, calcareous silty clay loam in the upper part and light gray, firm, calcareous silty clay in the lower part. Common accumulations of gypsum are in the lower part of the subsoil and in the underlying material. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam. In some areas shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Kyle, Pierre, and Savo soils. These soils make up less than 10 percent of any one mapped area. Kyle soils contain more clay in the subsoil than the Manzanola soil. They are in the lower positions on the landscape. Pierre soils contain more clay in the subsoil than the Manzanola soil and are 20 to 40 inches deep over shale. They are in positions on the landscape similar to those of the Manzanola soil. Savo soils are on terraces. Their surface layer is darker than that of the Manzanola soil.

Fertility and the content of organic matter are low in the Manzanola soil. Available water capacity is moderate or high. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is poorly suited to cultivated crops. Alfalfa and winter wheat are the main crops. Measures that control erosion, improve fertility, and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour stripcropping and terracing also help to control erosion.

This soil is only fairly well suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum growth is unlikely.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIe-1; Clayey range site.

MmE—Mathias-Midway-Rock outcrop complex, 15 to 30 percent slopes. This map unit occurs as areas of well drained, hilly and steep soils that are closely intermingled with areas of Rock outcrop. It is on mountains. The deep Mathias soil is on the higher, steeper parts of the landscape; the shallow Midway soil is on the lower parts; and the Rock outcrop generally occurs as rimrock on the sides of entrenched drainageways and on the upper sides of sandstone-capped ridges. Slopes generally face south or west and commonly are dissected by steep canyons. Many stones and boulders are on the surface. They range from 5 inches to 12 feet in diameter. Areas are about 45 to 65 percent Mathias soil, 15 to 25 percent Midway soil, and 5 to 15 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Mathias soil is dark grayish brown extremely stony very fine sandy loam about 2 inches thick. The subsurface layer is very fine sandy loam about 11 inches thick. It is light brownish gray in the upper part and dark brown in the lower part. The subsoil is about 20 inches thick. It is light brown, friable very fine sandy loam in the upper part and reddish yellow, friable very fine sandy loam and fine sandy loam in the lower part. The underlying material to a depth of 60 inches is reddish yellow fine sandy loam. The content of stones, boulders, and coarse rock fragments is 40 to 55 percent in the subsurface layer, subsoil, and underlying material. In places a thin layer of mulch is at the surface. In some areas the content of clay is lower and the content of coarse fragments less than 35 percent in the subsoil.

Typically, the surface layer of the Midway soil is pale olive, calcareous silty clay loam about 4 inches thick. Below this is a transition layer of light yellowish brown, calcareous silty clay loam about 4 inches thick. The underlying material is olive, firm, calcareous silty clay loam about 8 inches thick. It has common shale chips throughout. Pale yellow, calcareous shale is at a depth of about 16 inches. In some areas the soil contains more clay throughout.

The Rock outcrop is exposed sandstone. It is in rimrock areas and on vertical cliffs and the sides of hills.

Included with the Mathias and Midway soils and the Rock outcrop in mapping are small areas of Butche soils. These included soils make up less than 15 percent of any one mapped area. They are shallow over sandstone. They are above the rimrock areas. Also included are scattered small areas of mine pits.

Fertility and the content of organic matter are low in the Mathias and Midway soils. Available water capacity is low in the Mathias soil and very low in the Midway soil. Permeability is moderate in the Mathias soil and slow in the Midway soil. Runoff is rapid on both soils. The shrink-swell potential is high in the Midway soil.

Nearly all of the acreage is range. This map unit is fairly well suited to native grasses. The native vegetation on the Mathias soil dominantly is big bluestem, little bluestem, and needlegrass. That on the Midway soil dominantly is western wheatgrass, needlegrass, sideoats grama, and blue grama. Overused areas are dominated by needleandthread and blue grama.

Some areas of the Mathias soil support sparse stands of ponderosa pine. Timber is harvested in some areas, but production is low. Managing this map unit for timber is difficult because the trees are widely scattered, are in sparse stands, and grow slowly.

This map unit is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields. The slope is the main limitation. The stoniness of the Mathias soil and the shallowness of the Midway soil are additional limitations.

The Mathias soil is in capability unit VIe-12, Stony Hills range site, and woodland suitability subclass 6r; the Midway soil is in capability unit VIIe-5, Shallow range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

MnF—Mathias-Rockoa-Rock outcrop complex, 25 to 60 percent slopes. This map unit occurs as areas of deep, well drained, steep and very steep soils that are closely intermingled with areas of Rock outcrop. It is on mountains that commonly are dissected by deep, steep-walled canyons. Slopes generally are rough and broken. The Mathias soil is on dominantly south- and west-facing slopes below the Rock outcrop. The Rockoa soil is on dominantly north- and east-facing slopes below the Rock outcrop or in covelike areas having a higher moisture regime. Stones and boulders are on the surface. They range from 5 inches to 12 feet in diameter. Areas are irregular in shape and 50 to 1,400 acres in size. They are 40 to 55 percent Mathias soil, 35 to 50 percent Rockoa soil, and 15 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Mathias soil is dark grayish brown extremely stony very fine sandy loam about 2 inches thick. The subsurface layer is very fine sandy loam about 11 inches thick. It is light brownish gray in the upper part and dark brown in the lower part. The subsoil is about 20 inches thick. It is light brown, friable very fine sandy loam in the upper part and reddish yellow, friable very fine sandy loam and fine sandy loam in the lower part. The underlying material to a depth of 60 inches is reddish yellow fine sandy loam. The content of stones, boulders, and coarse rock fragments is 40 to 55 percent in the subsurface layer, subsoil, and underlying material. In places a thin layer of mulch is at

the surface. In some areas the content of clay is lower and the content of coarse fragments less than 35 percent in the subsoil.

Typically, the Rockoa soil has a 1-inch mulch of forest litter at the surface. The surface layer is dark grayish brown extremely stony fine sandy loam about 5 inches thick. The subsurface layer is light brownish gray fine sandy loam about 5 inches thick. Below this is a transition layer of light brown fine sandy loam about 5 inches thick. The subsoil is about 36 inches thick. It is brown, firm sandy clay loam over light brown, friable fine sandy loam. The underlying material to a depth of 60 inches is light brown fine sandy loam. The content of stones, boulders, and coarse fragments is 35 to 50 percent throughout the soil. In some areas the content of coarse fragments is lower.

The Rock outcrop is exposed sandstone. It is in rimrock areas and on vertical cliffs and the sides of hills.

Included with the Mathis and Rockoa soils and the Rock outcrop in mapping are small areas of Butche and Midway soils. These included soils make up less than 15 percent of any one mapped area. Butche soils are shallow over sandstone. They are above the rimrock areas. Midway soils are shallow over shale and contain more clay throughout than the Mathias and Rockoa soils. They are on the lower parts of the landscape. Also included are scattered small areas of mine pits.

Fertility is low in the Mathias soil and medium in the Rockoa soil. The content of organic matter is low in the Mathias soil and moderate in the Rockoa soil. Available water capacity is low in the Mathias soil and low or moderate in the Rockoa soil. Permeability is moderate in both soils. Runoff is rapid.

All areas are range or woodland. The Mathias soil is fairly well suited to range and poorly suited to woodland. The Rockoa soil is fairly well suited to woodland and poorly suited to range. The native vegetation on the Mathias soil dominantly is big bluestem, little bluestem, and needlegrass. That on the Rockoa soil dominantly is ponderosa pine and a sparse stand of shrubs and grasses. Overused areas of native grasses are dominated by needleandthread and blue grama.

Timber is harvested in many areas of the Rockoa soil. Harvesting is difficult in many areas, however, because the use of wheeled equipment is limited by the large boulders and the steep and very steep slopes. Erosion is a severe hazard if the surface is disturbed when the timber is harvested. Many areas of the Rockoa soil are inaccessible because they are in isolated coves and pockets. Building logging roads into these areas generally is too expensive.

This map unit is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because of the slope and the stoniness.

The Mathias soil is in capability unit VIIe-3, Stony Hills range site, and woodland suitability subclass 6r; the Rockoa soil is in capability unit VIIe-1 and woodland suitability subclass 5r and is not assigned to a range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

MoB—Minnequa silt loam, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping, calcareous soil is on uplands. Areas are irregular in shape and 10 to 600 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown, calcareous silt loam about 4 inches thick. Below this is a transition layer of light grayish brown, very friable, calcareous silty clay loam about 7 inches thick. The underlying material is pale brown, calcareous silty clay loam about 13 inches thick. Light gray limestone is at a depth of about 24 inches. In some areas shale is below a depth of 40 inches.

Included with this soil in mapping are small areas of Midway and Pierre soils. These soils make up less than 10 percent of any one mapped area. Midway soils contain more clay throughout than the Minnequa soil and have shale within a depth of 20 inches. They are on the higher, steeper parts of the landscape. Pierre soils contain more clay in the subsoil than the Minnequa soil. Their position on the landscape is similar to that of the Minnequa soil.

Fertility and the content of organic matter are low in the Minnequa soil. Available water capacity also is low. Permeability is moderate. Runoff is medium.

Most of the acreage is range. This soil is fairly well suited to native grasses. The native vegetation dominantly is needlegrass, blue grama, sedges, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

This soil is poorly suited to cultivated crops. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Measures that control erosion, conserve moisture, and improve fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour stripcropping also helps to control erosion.

This soil is poorly suited to windbreaks and environmental plantings because of the high content of lime in the surface layer. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

Because of the moderate depth to bedrock, this soil is only fairly well suited to building site development. The bedrock is soft and rippable, however, and can be excavated by suitable machinery. The soil generally is unsuited to septic tank absorption fields because bedrock is 20 to 40 inches from the surface.

The capability unit is IVe-8; Thin Upland range site.

MpE—Minnequa-Midway silty clay loams, 6 to 25 percent slopes. These well drained, gently rolling to hilly, calcareous soils are in areas on uplands where slopes are short. The moderately deep Minnequa soil is in the lower, less hilly areas. The Midway soil is on the higher, steeper side slopes and ridgetops. Areas are long and narrow or irregularly shaped and are 10 to 400 acres in size. They are about 40 to 60 percent Minnequa soil and 30 to 50 percent Midway soil. The two soils occur as areas so closely intermingled that mapping them separately is not practical.

Typically, the surface layer of the Minnequa soil is grayish brown, calcareous silty clay loam about 4 inches thick. Below this is a transition layer of light grayish brown, very friable, calcareous silty clay loam about 7 inches thick. The underlying material is pale brown, calcareous silty clay loam about 13 inches thick. Light gray limestone is at a depth of about 24 inches. In some areas shale is below a depth of 40 inches.

Typically, the surface layer of the Midway soil is pale olive, calcareous silty clay loam about 4 inches thick. Below this is a transition layer of light yellowish brown, calcareous silty clay loam about 4 inches thick. The underlying material is olive, firm, calcareous silty clay loam about 8 inches thick. It has common shale chips throughout. Pale yellow, calcareous shale is at a depth of about 16 inches. In some areas the soil contains more clay throughout.

Included with these soils in mapping are small areas of Penrose, Pierre, and Shingle soils. These included soils make up less than 15 percent of any one mapped area. Penrose soils contain less clay throughout than the Midway soil and are 10 to 20 inches deep over hard limestone bedrock. Their position on the landscape is similar to that of the Midway soil. Pierre soils contain more clay in the subsoil than the Minnequa soil. They are on the lower parts of the landscape. Shingle soils contain less clay throughout than the Midway soil. Their position on the landscape is similar to that of the Midway soil.

Fertility and the content of organic matter are low in the Minnequa and Midway soils. Available water capacity is low in the Minnequa soil and very low in the Midway soil. Permeability is moderate in the Minnequa soil and slow in the Midway soil. Runoff is rapid on both soils. The shrink-swell potential is high in the Midway soil.

All of the acreage is range. These soils are fairly well suited to native grasses. The native vegetation on the Minnequa soil dominantly is blue grama, needlegrasses, little bluestem, and western wheatgrass. That on the Midway soil dominantly is western wheatgrass, green needlegrass, and sideoats grama. Overused areas are dominated by blue grama, sedges, and buffalograss.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings. The slope is the main limitation. The shallowness to bedrock in the Midway soil is an additional limitation.

The Midway soil generally is unsuited to building site development, mainly because of the shallowness to bedrock and the slope. The Minnequa soil is only fairly well suited because of the moderate depth to bedrock and the slope. The bedrock is soft and can be excavated by suitable machinery. Land shaping is needed in most areas.

These soils generally are unsuited to septic tank absorption fields because bedrock is within a depth of 40 inches. The slope of the Midway soil is an additional limitation.

The Minnequa soil is in capability unit VIe-3, Thin Upland range site; the Midway soil is in capability unit VIe-12, Shallow range site.

MtA—Mitchell very fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level, calcareous soil is on terraces. Areas are irregular in shape and 10 to 140 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray, calcareous very fine sandy loam about 11 inches thick. Below this is a transition layer of light gray, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is light gray, calcareous very fine sandy loam. In some areas the soil is redder. In other areas it contains more clay throughout.

Included with this soil in mapping are small areas of Alice soils. These soils make up less than 10 percent of any one mapped area. They contain more sand in the subsoil than the Mitchell soil. Their position on the landscape is similar to that of the Mitchell soil.

Fertility and the content of organic matter are low in the Mitchell soil. Available water capacity is high. Permeability is moderate. Runoff is slow.

About half of the acreage is range. This soil is fairly well suited to native grasses. The native vegetation dominantly is blue grama, needlegrasses, and sedges. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is fairly well suited to cultivated crops. In some areas it is irrigated. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Measures that control wind erosion, conserve moisture, and improve fertility are the main management needs. Examples are minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface. Establishing field windbreaks also helps to control wind erosion.

This soil is fairly well suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely because of the high content of lime in the surface layer.

This soil is well suited to building site development and to septic tank absorption fields.

The capability unit is IIIe-1; Thin Upland range site.

MtB—Mitchell very fine sandy loam, 2 to 6 percent slopes. This deep, well drained, gently sloping, calcareous soil is on terraces. Areas are irregular in shape and 10 to 180 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray, calcareous very fine sandy loam about 11 inches thick. Below this is a transition layer of light gray, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is light gray, calcareous very fine sandy loam. In some areas the soil is redder. In other areas it contains more clay throughout.

Included with this soil in mapping are small areas of Alice soils. These soils make up less than 10 percent of any one mapped area. They contain more sand in the subsoil than the Mitchell soil. Their position on the landscape is similar to that of the Mitchell soil.

Fertility and the content of organic matter are low in the Mitchell soil. Available water capacity is high. Permeability is moderate. Runoff is slow.

About half of the acreage is range. This soil is fairly well suited to native grasses. The native vegetation dominantly is blue grama, needlegrasses, and sedges. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is fairly well suited to cultivated crops. In some areas it is irrigated. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Measures that control wind and water erosion, conserve moisture, and improve fertility are the main management needs. Examples are minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface. Establishing field windbreaks also helps to control wind erosion, and farming on the contour and terracing help to control water erosion.

This soil is fairly well suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely because of the high content of lime in the surface layer.

This soil is well suited to building site development and to septic tank absorption fields.

The capability unit is IIIe-1; Thin Upland range site.

NeD—Nevee silt loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on terraces and uplands that in some areas are dissected by drainageways and small gullies. Areas are irregular in shape and 10 to 130 acres in size. Slopes are long and smooth.

Typically, the surface layer is reddish brown, calcareous silt loam about 3 inches thick. The subsurface layer is yellowish red, calcareous silt loam about 5 inches thick. The underlying material is yellowish red, calcareous silt loam about 35 inches thick. Yellowish red siltstone is at a depth of about 43 inches. In some areas the soil is yellower.

Included with this soil in mapping are small areas of Spearfish and Tilford soils. These soils make up less than 10 percent of any one mapped area. Spearfish soils are 10 to 20 inches deep over siltstone. They are on the upper parts of side slopes and on breaks along drainageways. Tilford soils contain more clay in the subsoil than the Nevee soil. Their position on the landscape is similar to that of the Nevee soil.

Fertility and the content of organic matter are low in the Nevee soil. Available water capacity and permeability are moderate. Runoff is medium.

Most of the acreage is range. This soil is fairly well suited to native grasses. The native vegetation dominantly is needlegrass, blue grama, little bluestem, and western wheatgrass. Overused areas are dominated by blue grama and sedges. After continued overuse, the soil is subject to gullying and erosion is a severe hazard.

This soil generally is unsuited to cultivated crops because of the slope. The moderately sloping areas are better suited, but they cannot be farmed separately because they are closely intermingled with the strongly sloping areas.

Windbreaks and environmental plantings can be established in the moderately sloping areas. The high content of lime in the surface layer, however, adversely affects the availability of plant nutrients. Planting on the contour helps to control erosion.

This soil is only fairly well suited to building site development because of the slope. Land shaping is needed in most areas. The soil is only fairly well suited to septic tank absorption fields because of the slope and the bedrock within a depth of 4 feet. Enlarging the absorption area and designing the field so that it conforms to the natural slope of the land generally improve the efficiency of the absorption system.

The capability unit is VIe-3; Thin Upland range site.

NoA—Norka silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces and uplands. Areas are irregular in shape and 15 to 420 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsoil is about 15 inches thick. It is brown, very friable silt loam in the upper part and brown and light gray, friable and very friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In some areas bedrock is 20 to 40 inches from the surface. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Colby soils on the higher parts of the landscape. These soils make up less than 10 percent of any one mapped area. They are calcareous at the surface.

Fertility is medium and the content of organic matter moderate in the Norka soil. Available water capacity is high. Permeability is moderate. Runoff is slow.

Most of the acreage is cropland. This soil is fairly well suited to cultivated crops. Some areas are irrigated. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, and green needlegrass. Overused areas are dominanted by blue grama and sedges.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil is well suited to building site development and septic tank absorption fields.

The capability unit is IIIc-1; Silty range site.

NoB—Norka silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands. Areas are irregular in shape and 15 to 420 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsoil is about 15 inches thick. It is brown, very friable silt loam in the upper part and brown and light gray, friable and very friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In some areas the subsoil contains more sand, and in other areas it contains more clay. In places bedrock is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Colby soils on slight rises. These soils make up less than 10 percent of any one mapped area. They have free carbonates within a depth of 6 inches.

Fertility is medium and the content of organic matter moderate in the Norka soil. Available water capacity is high. Permeability is moderate. Runoff is slow.

Most of the acreage is cropland. This soil is fairly well suited to cultivated crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns. Minimizing tillage and leaving crop residue on the surface conserve moisture. Farming on the contour, terracing, and including grasses and legumes in the cropping system help to control erosion.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, and green needlegrass. Overused areas are dominated by blue grama and sedges.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion and conserves moisture.

This soil is well suited to building site development and septic tank absorption fields. Land shaping is needed on some building sites.

The capability unit is IIIe-1; Silty range site.

NoC—Norka silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces and uplands. Areas are irregular in shape and 15 to 300 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsoil is about 11 inches thick. It is brown, very friable silt loam in the upper part and brown and light gray, friable and very friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In places the subsoil contains more sand. In some areas bedrock is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Colby soils on the higher parts of the landscape. These soils make up less than 10 percent of any one mapped area. They have free carbonates within a depth of 6 inches.

Fertility is medium and the content of organic matter moderate in the Norka soil. Available water capacity is high. Permeability is moderate. Runoff is medium.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is blue grama, green needlegrass, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Controlling erosion and conserving moisture are the main management concerns. Contour stripcropping, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system help to control erosion. Minimizing tillage and leaving crop residue on the surface conserve moisture.

This soil is well suited to windbreaks and environmental plantings. Planting the trees and shrubs on the contour helps to control erosion and conserves moisture.

This soil is well suited to building site development and septic tank absorption fields. Land shaping is needed on some building sites.

The capability unit is IVe-1; Silty range site.

NuA—Nunn clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces and uplands. Areas are irregular in shape and 10 to 540 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown clay loam about 5 inches thick. The subsoil is about 20 inches of dark grayish brown and brown, firm and friable clay loam and clay. It is calcareous in the lower part. The upper part of the underlying material is grayish brown and dark grayish brown, calcareous loam. The lower part

to a depth of 60 inches is pale brown, calcareous sandy loam. In places the subsoil contains more silt and less sand.

Included with this soil in mapping are small areas of Satanta soils on terraces. These soils make up less than 10 percent of any one mapped area. Their subsoil contains less clay than that of the Nunn soil.

Fertility is medium and the content of organic matter moderate in the Nunn soil. Available water capacity is moderate or high. Runoff is slow. Permeability is slow or moderately slow. The shrink-swell potential is high in the subsoil.

About half of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is green needlegrass, western wheatgrass, blue grama, and buffalograss. Overused areas are dominated by blue grama and buffalograss.

This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Some areas are irrigated. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIc-1; Clayey range site.

NuB—Nunn clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands. Areas are irregular in shape and 15 to 300 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown clay loam about 5 inches thick. The subsoil is about 20 inches of dark grayish brown and brown, firm and friable clay loam and clay. It is calcareous in the lower part. The upper part of the underlying material is grayish brown and dark grayish brown, calcareous loam. The lower part to a depth of 60 inches is pale brown, calcareous sandy loam. In places the subsoil contains more silt and less sand.

Included with this soil in mapping are small areas of Satanta soils on terraces. These soils make up less than 10 percent of any one mapped area. Their subsoil contains less clay than that of the Nunn soil.

Fertility is medium and the content of organic matter moderate in the Nunn soil. Available water capacity is moderate or high. Permeability is slow or moderately slow. Runoff is medium. The shrink-swell potential is high in the subsoil.

About half of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is green needlegrass, western wheatgrass, blue grama, and buffalograss. Overused areas are dominated by blue grama and buffalograss.

This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns. Minimizing tillage and leaving crop residue on the surface conserve moisture. Farming on the contour, terracing, and including grasses and legumes in the cropping system help to control erosion.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion and conserves moisture.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIe-1; Clayey range site.

NuC—Nunn clay loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces and uplands. Areas are irregular in shape and 15 to 80 acres in size. Slopes are short and smooth.

Typically, the surface layer is dark grayish brown clay loam about 5 inches thick. The subsoil is about 20 inches of dark grayish brown and brown, firm and friable clay loam and clay. It is calcareous in the lower part. The upper part of the underlying material is grayish brown and dark grayish brown, calcareous loam. The lower part to a depth of 60 inches is pale brown, calcareous sandy loam. In places the subsoil contains more silt and less sand.

Included with this soil in mapping are small areas of Satanta soils on terraces. These soils make up less than 10 percent of any one mapped area. Their subsoil contains less clay than that of the Nunn soil.

Fertility is medium and the content of organic matter moderate in the Nunn soil. Available water capacity is moderate or high. Permeability is slow or moderately

slow. Runoff is medium. The shrink-swell potential is high in the subsoil.

Most areas are range. This soil is well suited to native grasses. The native vegetation dominantly is green needlegrass, western wheatgrass, blue grama, and buffalograss. Overused areas are dominated by blue grama and buffalograss.

This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Controlling erosion and conserving moisture are the main management concerns. Farming on the contour, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system help to control erosion. Minimizing tillage and leaving crop residue on the surface conserve moisture.

This soil is well suited to windbreaks and environmental plantings. Planting the trees and shrubs on the contour helps to control erosion and conserves moisture.

This soil is poorly suited to most kinds of building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IVe-1; Clayey range site.

OrE—Orella-Rock outcrop complex, 6 to 40 percent slopes. This map unit occurs as areas of a shallow, well drained, gently rolling to steep soil that are closely intermingled with areas of Rock outcrop. It is in areas on uplands where slopes generally are short. The Orella soil is on the lower, less steep parts of side slopes. The Rock outcrop is on the higher, rounded knolls and on ridgetops. In many areas scattered pebbles are on the surface. Areas are irregular in shape and 20 to 1,000 acres in size. They are 50 to 70 percent Orella soil and 20 to 40 percent Rock outcrop. The Orella soil and the Rock outcrop occur as areas so intermingled that mapping them separately is not practical.

Typically, the surface layer of the Orella soil is light brownish gray, calcareous silty clay about 2 inches thick. Below this is a transition layer of light gray, very firm, calcareous clay about 10 inches thick. The underlying material is light gray, calcareous clay about 6 inches thick. White, massive shale is at a depth of about 18 inches.

The Rock outcrop is alkaline clayey shale. In many areas on low, rounded hills and mounds, it consists of alternating bands that range from white to red and are several feet thick. It supports little or no vegetation.

Included with the Orella soil and Rock outcrop in mapping are small areas of Bufton and Epping soils. These included soils make up less than 10 percent of any one mapped area. Bufton soils are more than 40 inches deep over bedrock and are not so clayey as the Orella soil. They are in the lower, less sloping areas. Epping soils are silty. Their position on the landscape is similar to that of the Orella soil.

Fertility and the content of organic matter are low in the Orella soil. Available water capacity is very low. Permeability is very slow. Runoff is rapid. The shrink-swell potential is high.

Nearly all of the acreage is range. The Orella soil is fairly well suited to native grasses. The Rock outcrop supports little or no vegetation. The native vegetation on the Orella soil dominantly is blue grama and western wheatgrass. Overused areas are dominated by blue grama and buffalograss.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because of the shallowness to shale and the slope.

The Orella soil is in capability unit VIIe-5, Shallow Clay range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

PaD—Paunsaugunt-Boneek complex, 6 to 15 percent slopes. These well drained, gently rolling and rolling soils are on mountains and uplands. The shallow Paunsaugunt soil is in convex areas on the tops of ridges and knolls. The deep Boneek soil is in concave areas on the lower parts of the landscape. Areas are irregular in shape and 20 to 450 acres in size. They are 40 to 55 percent Paunsaugunt soil and 25 to 40 percent Boneek soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Paunsaugunt soil is dark grayish brown, calcareous gravelly loam about 3 inches thick. The subsurface layer is grayish brown, calcareous gravelly loam about 5 inches thick. The surface and subsurface layers have many coarse fragments. The underlying material is light brownish gray, calcareous channery loam about 6 inches thick. Hard limestone bedrock is at a depth of about 14 inches. In places the surface layer is not so dark. In some areas the soil is not calcareous.

Typically, the surface layer of the Boneek soil is brown silt loam about 7 inches thick. The subsoil is firm silty clay loam about 13 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material is pale brown and very pale brown, calcareous clay loam about 21 inches thick. Sandstone is at a depth of about 41 inches. In places it is 30 to 40 inches from the surface.

Included with these soils in mapping are small areas of Tilford soils and Rock outcrop. These inclusions make

up less than 15 percent of any one mapped area. Tilford soils are redder than the Paunsaugunt and Boneek soils. They are on the lower parts of the landscape. The Rock outcrop is exposed sandstone and limestone on ridgetops, knolls, and the sides of drainageways.

Fertility and the content of organic matter are low in the Paunsaugunt soil. Fertility is medium and the content of organic matter moderate in the Boneek soil. Available water capacity is very low in the Paunsaugunt soil and moderate in the Boneek soil. Permeability is moderate above the bedrock in the Paunsaugunt soil. It is moderately slow in the Boneek soil. Runoff is rapid on both soils. The shrink-swell potential is moderate in the subsoil of the Boneek soil.

Most of the acreage is range. Nearly all areas are grazed. The native vegetation on the Paunsaugunt soil dominantly is a sparse stand of ponderosa pine and an understory of sedges and mid grasses. That on the Boneek soil is western wheatgrass, blue grama, needleandthread, and green needlegrass. Overused areas of this soil are dominated by blue grama and sedges. Timber yields are limited because the stands of ponderosa pine are sparse.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings. The shallowness of the Paunsaugunt soil is the main limitation. The Boneek soil is better suited, but it cannot be managed separately because it occurs as areas too closely intermingled with areas of the Paunsaugunt soil.

The Paunsaugunt soil generally is too shallow for building site development and septic tank absorption fields. The Boneek soil is only fairly well suited to building site development because of the moderate shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Boneek soil is only fairly well suited to septic tank absorption fields because of the restricted permeability and the bedrock within a depth of 60 inches. Enlarging the absorption area helps to overcome the slow absorption of liquid waste. Installing the distribution lines across the slope generally improves the efficiency of these fields.

The Paunsaugunt soil is in capability unit VIs-2, Shallow range site; the Boneek soil is in capability unit IVe-1, Silty range site.

PbF—Paunsaugunt-Vanocker-Rock outcrop complex, 9 to 60 percent slopes. This map unit occurs as areas of well drained, strongly sloping to very steep soils that are closely intermingled with areas of Rock outcrop. It is on mountains. The shallow Paunsaugunt soil dominantly is on ridges. The deep Vanocker soil is on side slopes below the Rock outcrop. The Rock outcrop consists of ledges of limestone or sandstone on the rims of drainageways, on the top of canyon walls, and on steep mountain peaks. Areas are irregular in shape and 100 to 1,400 acres in size. They are 45 to 55 percent Paunsaugunt soil, 35 to 45 percent Vanocker soil, and 15 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so intermingled that mapping them separately is not practical.

Typically, the surface layer of the Paunsaugunt soil is dark grayish brown, calcareous gravelly loam about 3 inches thick. The subsurface layer is grayish brown, calcareous gravelly loam about 5 inches thick. The surface and subsurface layers have many coarse fragments. The underlying material is light brownish gray, calcareous channery loam about 6 inches thick. Hard limestone bedrock is at a depth of about 14 inches. In places the surface layer is not so dark.

Typically, about 3 inches of organic litter is at the surface of the Vanocker soil. The surface layer is dark grayish brown, calcareous gravelly loam about 3 inches thick. The subsoil is brown, very friable, calcareous gravelly and channery loam about 14 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous channery loam.

The Rock outcrop is exposed hard limestone or calcareous sandstone.

Included with the Paunsaugunt and Vanocker soils and Rock outcrop in mapping are small areas of Boneek, Spearfish, and Tilford soils. These included soils make up less than 15 percent of any one mapped area. Boneek soils are 40 to 60 inches deep over hard sandstone bedrock. They are in the rolling, less wooded areas. The shallow Spearfish soils are in areas below the Vanocker soil. They are redder than the Paunsaugunt and Vanocker soils. Their content of coarse fragments is less than 35 percent throughout. The deep, silty Tilford soils are in the lower lying, treeless areas on long, smooth slopes. Their content of coarse fragments is lower than that of either the Paunsaugunt or Vanocker soil.

Fertility and the content of organic matter are low in the Paunsaugunt soil. Fertility is medium and the content of organic matter moderate in the Vanocker soil. Available water capacity is very low in the Paunsaugunt soil and moderate in the Vanocker soil. Permeability is moderate above the bedrock in the Paunsaugunt soil and moderate in the Vanocker soil. Runoff is rapid on both soils.

Most of the acreage is forested with ponderosa pine and used for limited grazing. The Paunsaugunt soil is poorly suited to range and woodland. The Vanocker soil is fairly well suited to woodland and poorly suited to range. A few sparsely timbered spots having an understory of grass are throughout the mapped areas. The native vegetation on the Paunsaugunt soil dominantly is a thin stand of stunted ponderosa pine and an understory of shrubs and sparse grasses. The

Vanocker soil supports a denser stand of ponderosa pine and grass.

Timber is harvested in many areas of the Vanocker soil. Harvesting is difficult in many areas, however, because the use of wheeled equipment is limited by the very steep slopes. Erosion is a severe hazard if the surface is disturbed when the timber is harvested. Also, landslides are a hazard if the surface of the very steep Vanocker soil is disturbed.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields. The slope is the main limitation.

The Paunsaugunt soil is in capability unit VIIs-1, Shallow range site, and woodland suitability subclass 6d; the Vanocker soil is in capability unit VIIe-9, woodland suitability subclass 5f, and is not assigned to a range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

PeB—Pierre clay, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 20 to 1,600 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is light brownish gray, very firm, calcareous clay about 25 inches thick. It has many accumulations of lime in the lower part. The underlying material is light brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray shale is at a depth of about 34 inches. In some areas it is more than 40 inches from the surface. In other areas the soil is acid throughout. In places the slope is as much as 8 percent.

Included with this soil in mapping are small areas of Grummit, Samsil, and Savo soils. These soils make up less than 10 percent of any one mapped area. Grummit and Samsil soils are 6 to 20 inches deep over shale. They are on the higher, steeper parts of the landscape. Also, Grummit soils are acid throughout. Savo soils are not underlain by shale and contain less clay in the subsoil than the Pierre soil. They are on terraces.

Fertility is medium and the content of organic matter low in the Pierre soil. Tilth is poor. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is green needlegrass, western wheatgrass, and blue grama. Overused areas are dominated by blue grama, buffalograss, and sedges.

This soil is poorly suited to cultivated crops. Alfalfa and winter wheat are the main crops. The soil is subject to surface compaction if tilled when wet and cannot be easily tilled when dry. Controlling erosion, conserving moisture, and improving tilth and fertility are the main management concerns. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to control wind erosion, improve tilth, and conserve moisture. Contour farming, terracing, and establishing grassed waterways help to control water erosion.

This soil is only fairly well suited to windbreaks and environmental plantings. Windbreaks can be established, but optimum growth is unlikely.

Because of the very high shrink-swell potential, this soil is poorly suited to most kinds of building site development. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the very restricted permeability, this soil generally is unsuited to septic tank absorption fields. It is suitable as a site for sewage lagoons, but the moderate depth to shale is a limitation.

The capability unit is IVe-3; Clayey range site.

PgE—Pierre-Grummit clays, 6 to 25 percent slopes. These well drained, gently rolling to hilly soils are in areas on uplands where slopes are rough or broken. Deep channels dissect some of the steeper areas. The moderately deep Pierre soil generally is on the lower, less sloping parts of the landscape. The shallow Grummit soil is on the higher, hillier parts. Areas are irregular in shape and 15 to 800 acres in size. They are 40 to 50 percent Pierre soil and 40 to 50 percent Grummit soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is light brownish gray, very firm, calcareous clay about 25 inches thick. It has many accumulations of lime in the lower part. The underlying material is light brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray shale is at a depth of about 34 inches. In some areas it is more than 40 inches from the surface. In other areas the soil is acid throughout. In places it has visible salt crystals throughout.

Typically, the surface layer of the Grummit soil is light brownish gray, very strongly acid clay about 4 inches thick. The underlying material is grayish brown, extremely acid shaly clay about 7 inches thick. Light gray, extremely acid shale is at a depth of about 11 inches. In some areas the soil is calcareous throughout.

Included with these soils in mapping are small areas of Rock outcrop on ridges, hilltops, and sharp breaks along drainageways. The Rock outcrop makes up less than 10 percent of any one mapped area. It is acid shale.

Fertility is medium in the Pierre soil and low in the Grummit soil. The content of organic matter is low in

both soils. Tilth is poor. Available water capacity is low in the Pierre soil and very low in the Grummit soil. Permeability is very slow in the Pierre soil and moderate in the Grummit soil. Runoff is rapid on both soils. The shrink-swell potential is very high in the Pierre soil and high in the Grummit soil.

All of the acreage is range. The Pierre soil is well suited and the Grummit soil fairly well suited to native grasses. The native vegetation on the Pierre soil dominantly is green needlegrass, blue grama, and western wheatgrass. That on the Grummit soil dominantly is little bluestem, western wheatgrass, and blue grama. A few scattered ponderosa pine grow in some areas of the Grummit soil. Overused areas are dominated by blue grama and sedges.

These soils generally are too steep and too shallow for cultivated crops and windbreaks and environmental plantings. They generally are unsuited to most kinds of building site development and to septic tank absorption fields. The slope is the main limitation. The very high or high shrink-swell potential of both soils and the shallowness to shale in the Grummit soil are additional limitations on building sites. The very restricted permeability in the Pierre soil and the shallowness to shale in the Grummit soil are additional limitations in septic tank absorption fields.

The Pierre soil is in capability unit VIe-4, Clayey range site; the Grummit soil is in capability unit VIe-12, Shallow Clay range site.

PsE—Pierre-Samsil clays, 6 to 25 percent slopes. These well drained, moderately sloping to moderately steep soils are on uplands. Deep channels dissect some of the steeper areas. The moderately deep Pierre soil is on the lower, less sloping parts of the landscape. The shallow Samsil soil is on the higher ridges and on hilltops. Areas are irregular in shape and 20 to 4,600 acres in size. They are 40 to 50 percent Pierre soil and 40 to 50 percent Samsil soil. These two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is light brownish gray, very firm, calcareous clay about 25 inches thick. It has many accumulations of lime in the lower part. The underlying material is light brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray shale is at a depth of 34 inches. In some areas it is more than 40 inches from the surface. In other areas the soil is acid throughout. In places it has visible salt crystals throughout.

Typically, the surface layer of the Samsil soil is light brownish gray, calcareous clay about 3 inches thick. Below this is a transition layer of light brownish gray, calcareous clay about 5 inches thick. The underlying material is light brownish gray and light gray, calcareous shaly clay about 10 inches thick. Light gray shale is at a depth of about 18 inches. In places the soil is acid throughout. In some areas it contains less clay throughout.

Included with these soils in mapping are small areas of Hisle soils in swales and along drainageways. These included soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil.

Fertility is medium in the Pierre soil and low in the Samsil soil. The content of organic matter is low in both soils. Tilth is poor. Available water capacity is low in the Pierre soil and very low in the Samsil soil. Permeability is very slow in the Pierre soil and slow in the Samsil soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

Most of the acreage is range. The Pierre soil is well suited and the Samsil soil fairly well suited to native grasses. The native vegetation on the Pierre soil dominantly is green needlegrass, blue grama, and western wheatgrass. That on the Samsil soil dominantly is little bluestem, western wheatgrass, and sideoats grama. Overused areas are dominated by blue grama and sedges. Many small gullies form after continued overuse.

These soils generally are too steep and too shallow for cultivated crops and windbreaks and environmental plantings. They generally are unsuited to most kinds of building site development and to septic tank absorption fields. The very high shrink-swell potential is the main limitation on building sites. The slope of both soils and the shallowness to shale in the Samsil soil are additional limitations. The shallowness to shale in both soils and the very restricted permeability in the Pierre soil are the main limitations in septic tank absorption fields.

The Pierre soil is in capability unit VIe-4, Clayey range site; the Samsil soil is in capability unit VIe-12, Shallow Clay range site.

Pt—Pits, gravel. These are open excavations, 5 to 30 feet deep, from which sand and gravel have been removed. They are irregular in shape and range from 5 to 250 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottoms to almost vertical on the rims. Some of the pit bottoms are covered with water.

The pit bottoms typically are sand and gravel, but they are loam or clay loam alluvium where all of the sand and gravel has been removed. Mounds of mixed loamy overburden are on the edges of the pits. The bottoms and sides support little or no vegetation during periods when the pits are used.

Most gravel pits are used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to range or cropland if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as topsoil

dressing. Applying fertilizer as needed helps to establish range or pasture.

The capability unit is VIIIs-2; no range site is assigned.

Pu—Pits, mine. These are open excavations, 10 to 100 feet deep, from which various kinds of ore have been removed. They are irregular in shape and range from 5 to 210 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottoms to almost vertical on the rims. Some of the pit bottoms are covered with water.

The pit bottoms typically are sandstone and limestone bedrock. Mounds of mixed loamy overburden are on the edges of the pits. The bottoms and sides support little or no vegetation during periods when the pits are used.

Most mine pits provide limited wildlife habitat. Abandoned mine pits can be restored to range if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as topsoil dressing. Applying fertilizer as needed helps to establish range or pasture.

The capability subclass is VIIIs-2; no range site is assigned.

ReD—Rekop-Tilford-Gystrum complex, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are in areas on uplands where slopes are rough and broken. The shallow Rekop soil is on the tops of ridges and knolls. The deep Tilford soil is in the lower concave areas. The moderately deep Gystrum soil is on mid slopes and in the less sloping areas on side slopes. Areas are irregular in shape and 10 to 600 acres in size. They are 20 to 35 percent Rekop soil, 20 to 35 percent Tilford soil, and 15 to 25 percent Gystrum soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Rekop soil is light reddish brown, calcareous loam about 4 inches thick. The underlying material is pink, calcareous loam about 11 inches thick. It has common accumulations of lime and gypsum. In some areas the bedrock is within a depth of 10 inches.

Typically, the surface layer of the Tilford soil is reddish brown silt loam about 4 inches thick. The subsoil is about 14 inches of reddish brown, red, and light red, very friable silty clay loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is red, calcareous silt loam. In some areas the subsoil contains more clay.

Typically, the surface layer of the Gystrum soil is reddish brown, calcareous silty clay loam about 3 inches thick. The subsoil is light brown, friable, calcareous silty clay loam about 8 inches thick. The underlying material is reddish yellow, calcareous silt loam about 17 inches thick. Gypsum bedrock is at a depth of about 28 inches.

Included with these soils in mapping are small areas of Spearfish soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. Spearfish soils do not have gypsum bedrock within a depth of 20 inches. Their position on the landscape is similar to that of the Rekop soil. The Rock outcrop is pink and reddish siltstone, sandstone, and shale. It is on ridges and knolls.

Fertility and the content of organic matter are low in the Rekop soil. Fertility is medium and the content of organic matter moderate in the Tilford and Gystrum soils. Available water capacity is very low in the Rekop soil, high in the Tilford soil, and low in the Gystrum soil. Permeability is moderate in all three soils. Runoff is medium. The shrink-swell potential is moderate in the Gystrum soil.

Most of the acreage is range. The Rekop and Gystrum soils are fairly well suited and the Tilford soil well suited to native grasses. The native vegetation on the Rekop and Gystrum soils dominantly is little bluestem, needlegrass, and sideoats grama. That on the Tilford soil dominantly is little bluestem, western wheatgrass, big bluestem, and green needlegrass. Overused areas are dominated by blue grama and sedges.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings. Trees and shrubs can be planted for special purposes on the Tilford soil.

The Tilford soil is a better site for buildings and septic tank absorption fields than the Rekop and Gystrum soils. The depth to bedrock is the main limitation of the Rekop and Gystrum soils.

The Rekop and Gystrum soils are in capability unit VIe-11 and the Tilford soil in capability unit IIIe-1; the Rekop soil is in Shallow range site, the Tilford soil in Silty range site, and the Gystrum soil in Thin Upland range site.

RgF—Rock outcrop-Gystrum complex, 9 to 50 percent slopes. This map unit occurs as areas of Rock outcrop closely intermingled with areas of a moderately deep, well drained, strongly sloping to very steep soil. It is in areas on uplands where slopes are short and are rough or broken. The Rock outcrop is on the tops of knolls and ridges. The Gystrum soil is on side slopes below the Rock outcrop. Areas are irregular in shape and 10 to 1,900 acres in size. They are about 45 to 60 percent Rock outcrop and 30 to 40 percent Gystrum soil. The Rock outcrop and the Gystrum soil occur as areas so closely intermingled or so small that mapping them separately is not practical.

The Rock outcrop is slightly weathered gypsum bedrock. In some areas 1 to 3 inches of soil material supports a few annual weeds.

Typically, the surface layer of the Gystrum soil is reddish brown, calcareous silty clay loam about 3 inches thick. The subsoil is light brown, friable, calcareous silty

clay loam about 8 inches thick. The underlying material is reddish yellow, calcareous silt loam about 17 inches thick. Gypsum bedrock is at a depth of about 28 inches. In places it is below a depth of 40 inches.

Included with the Rock outcrop and Gystrum soil in mapping are small areas of Rekop, Spearfish, and Tilford soils. These included soils make up less than 15 percent of any one mapped area. Rekop and Spearfish soils are 10 to 20 inches deep over bedrock. Rekop soils are in positions on the landscape similar to those of the Gystrum soil, and Spearfish soils are on the tops and sides of ridges and on the shoulders of drainageways. The deep Tilford soils are on the smoother, lower parts of the landscape where slopes are long.

Fertility is medium and the content of organic matter moderate in the Gystrum soil. Available water capacity is low. Permeability is moderate. Runoff is medium.

All of the acreage is range. This map unit is poorly suited to range because of the extent of the Rock outcrop. The native vegetation on the Gystrum soil dominantly is little bluestem, needlegrass, threadleaf sedge, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because of the extent of the Rock outcrop and the slope.

The Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site; the Gystrum soil is in capability unit VIIe-3, Thin Upland range site.

RoF—Rock outcrop-Mathias-Butche complex, 30 to 75 percent slopes. This map unit occurs as areas of Rock outcrop closely intermingled with areas of well drained, steep and very steep soils. It is in areas on mountains where slopes are short and generally face south and west. It commonly is dissected by steep-walled canyons. The deep Mathias soil is on slopes below the Rock outcrop (fig. 9). The shallow Butche soil is on slopes above the Rock outcrop. Many stones and boulders as much as 12 feet in diameter are on the

Figure 9.—An area of Rock outcrop-Mathias-Butche complex, 30 to 75 percent slopes. The Mathias soil is on the side slopes.

surface of both soils. Areas are irregular in shape and 50 to 1,500 acres in size. They are 30 to 45 percent Rock outcrop, 25 to 40 percent Mathias soil, and 20 to 30 percent Butche soil. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

The Rock outcrop is exposed sandstone on vertical cliffs and ledges.

Typically, the surface layer of the Mathias soil is dark grayish brown extremely stony very fine sandy loam about 2 inches thick. The subsurface layer is very fine sandy loam about 11 inches thick. It is light brownish gray in the upper part and brown in the lower part. The subsoil is about 20 inches thick. It is light brown, friable very fine sandy loam in the upper part and reddish yellow, friable very fine sandy loam and fine sandy loam in the lower part. The underlying material to a depth of 60 inches is reddish yellow fine sandy loam. The content of stones, boulders, and coarse rock fragments is 40 to 55 percent in the subsurface layer, subsoil, and underlying material. In places a thin layer of mulch is at the surface. In some areas, the content of clay is lower and the content of coarse fragments less than 35 percent in the subsoil.

Typically, the surface layer of the Butche soil is brown fine sandy loam about 4 inches thick. The underlying material is light yellowish brown channery fine sandy loam about 5 inches thick. Very pale brown hard sandstone is at a depth of about 9 inches. In places lime is at or near the surface. In some areas the soil contains more clay throughout.

Included with the Rock outcrop and Mathias and Butche soils in mapping are small areas of Midway soils on the lower, less sloping parts of the landscape. These included soils make up less than 15 percent of any one mapped area. They contain more clay throughout than the Mathias and Butche soils. Also included are many scattered areas that are mined.

Fertility and the content of organic matter are low in the Mathias and Butche soils. Available water capacity is low in the Mathias soil and very low in the Butche soil. Permeability is moderate in both soils. Runoff is rapid.

Nearly all of the acreage supports native vegetation and is used for grazing. This map unit is poorly suited to range. The native vegetation on the Mathias soil dominantly is big bluestem, little bluestem, and needlegrass and, in some areas, sparse stands of ponderosa pine. That on the Butche soil dominantly is little bluestem, needleandthread, western wheatgrass, and prairie sandreed. Obtaining a uniform distribution of grazing is difficult because of the steep and very steep slopes and the ledges of exposed bedrock.

Timber is harvested in some areas of the Mathias soil, but production is low. Managing this map unit for timber is difficult because the trees are in widely scattered areas, are in sparse stands, and grow slowly and because slopes are steep and very steep. Landslides are a hazard if the surface is disturbed when the timber is harvested.

This map unit is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields. The slope and the extent of the Rock outcrop are the main limitations. Stoniness is an additional limitation.

The Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site; the Mathias soil is in capability unit VIIe-3, Stony Hills range site, and woodland suitability subclass 6r; the Butche soil is in capability unit VIIs-1, Shallow range site.

RrF—Rockoa-Rock outcrop complex, 25 to 60 percent slopes. This map unit occurs as areas of a deep, well drained, steep and very steep Rockoa soil that are closely intermingled with areas of Rock outcrop. It generally is on north- and northeast-facing slopes in the mountains. It commonly is dissected by steep-walled canyons. The Rockoa soil is on the steeper parts of the landscape below the Rock outcrop. The Rock outcrop generally is on the higher parts of the landscape. Many stones and boulders as much as 12 feet in diameter are on the surface of the Rockoa soil. Areas are irregular in shape and 40 to 400 acres in size. They are about 65 to 75 percent Rockoa soil and 20 to 30 percent Rock outcrop. The Rockoa soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the Rockoa soil has a 1-inch mulch of forest litter at the surface. The surface layer is dark grayish brown extremely stony fine sandy loam about 5 inches thick. The subsurface layer is light brownish gray fine sandy loam about 5 inches thick. Below this is a transition layer of light brown fine sandy loam about 5 inches thick. The subsoil is about 36 inches thick. It is brown, firm sandy clay loam over light brown, friable fine sandy loam. The underlying material to a depth of 60 inches is light brown fine sandy loam. The content of stones, boulders, and coarse rock fragments is 30 to 50 percent throughout the soil. In some areas the content of coarse fragments is lower.

The Rock outcrop is exposed sandstone on vertical cliffs and ledges.

Included with the Rockoa soil and Rock outcrop in mapping are small areas of Butche soils. These included soils make up less than 15 percent of any one mapped area. They have bedrock within a depth of 20 inches. They are in areas above the Rock outcrop. Also included are many scattered areas that are mined.

Fertility is medium and the content of organic matter moderate in the Rockoa soil. Available water capacity is low or moderate. Permeability is moderate. Runoff is rapid.

Most of the acreage is used for timber. Some areas are used for limited grazing. The Rockoa soil is fairly well suited to woodland. The native vegetation dominantly is

ponderosa pine and a sparse understory of shrubs and grasses. Harvesting the timber is difficult in many areas because the use of wheeled equipment is limited by the large boulders and the steep and very steep slopes. Erosion is a severe hazard if the surface is disturbed when the timber is harvested. Also, landslides are a hazard. Many areas of the Rockoa soil are inaccessible because they are in isolated coves and pockets. Building logging roads into these areas generally is too expensive.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because of the slope and stoniness.

The Rockoa soil is in capability unit VIIe-1 and woodland suitability subclass 5r and is not assigned to a range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

SaE—Samsil clay, 15 to 40 percent slopes. This shallow, well drained, moderately steep and steep soil is on uplands that generally are dissected by gullies, ravines, and drainageways. Areas are irregular in shape and 10 to 800 acres in size.

Typically, the surface layer is light brownish gray, calcareous clay about 3 inches thick. Below this is a transition layer of light brownish gray, calcareous clay about 5 inches thick. The underlying material is light brownish gray and light gray, calcareous shaly clay about 10 inches thick. Light gray shale is at a depth of about 18 inches. In some areas the soil is acid throughout. In other areas it contains less clay throughout.

Included with this soil in mapping are small areas of Hisle and Pierre soils and Rock outcrop. These inclusions make up less than 10 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are in swales and drainageways. Pierre soils are 20 to 40 inches deep over shale. They are lower on the landscape than the Samsil soil. The Rock outcrop commonly is on rounded knobs and hilltops. It supports little or no vegetation.

Fertility and the content of organic matter are low in the Samsil soil. Available water capacity is very low. Permeability is slow. Runoff is very rapid. The shrink-swell potential is very high.

All of the acreage is range. This soil is fairly well suited to native grasses. The native vegetation dominantly is western wheatgrass, little bluestem, and sideoats grama. Overused areas are dominated by blue grama and sedges. After continued overuse, bare areas are common.

This soil is too steep and too shallow for cultivated crops and windbreaks and environmental plantings. It generally is unsuited to building site development and septic tank absorption fields. The shallowness to shale and the slope are the main limitations. Also, the very high shrink-swell potential is a limitation on building sites.

The capability unit is VIIe-5; Shallow Clay range site.

SbD—Samsil-Pierre clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands that commonly are dissected by drainage channels. The shallow Samsil soil is on the higher, steeper parts of the landscape. The moderately deep Pierre soil is on the lower, less sloping parts. Areas are irregular in shape and 15 to 180 acres in size. They are about 50 to 70 percent Samsil soil and 25 to 40 percent Pierre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Samsil soil is light brownish gray, calcareous clay about 3 inches thick. Below this is a transition layer of light brownish gray, calcareous clay about 5 inches thick. The underlying material is light brownish gray and light gray, calcareous shaly clay about 10 inches thick. Light gray shale is at a depth of about 18 inches. In some areas the soil is acid throughout. In other areas it contains less clay throughout.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is light brownish gray, very firm, calcareous clay about 25 inches thick. It has many accumulations of lime in the lower part. The underlying material is light brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray shale is at a depth of about 34 inches. In places it is more than 40 inches from the surface. In some areas the soil is acid throughout. In other areas it has visible salt crystals throughout.

Included with these soils in mapping are small areas of Hisle soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are in swales and drainageways. The Rock outcrop commonly is on hilltops. It supports little or no vegetation.

Fertility is low in the Samsil soil and medium in the Pierre soil. The content of organic matter is low in both soils. Tilth is poor. Available water capacity is very low in the Samsil soil and low in the Pierre soil. Permeability is slow in the Samsil soil and very slow in the Pierre soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

All of the acreage is range. The Samsil soil is fairly well suited and the Pierre soil well suited to native grasses. The native vegetation dominantly is green needlegrass, little bluestem, sideoats grama, and western wheatgrass. Overused areas are dominated by blue grama and sedges. After continued overgrazing, bare areas are common.

These soils generally are too steep and too shallow for cultivated crops and windbreaks and environmental plantings.

The Samsil soil generally is unsuited to building site development because it is shallow. The Pierre soil is

poorly suited, mainly because of the very high shrink-swell potential. The moderate depth to shale also is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Land shaping is needed in some areas.

These soils generally are unsuited to septic tank absorption fields. The very restricted permeability of the Pierre soil and the shale within a depth of 40 inches in both soils are the main limitations. Sewage lagoons can be used as an alternative sewage disposal system, but the depth to shale and the slope are limitations.

The Samsil soil is in capability unit VIe-12, Shallow Clay range site; the Pierre soil is in capability unit VIe-4, Clayey range site.

ScA—Satanta loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces. Areas are irregular in shape and 10 to 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown loam about 8 inches thick. The subsoil is about 30 inches of brown, pale brown, and light brownish gray clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous fine sandy loam. In some areas the subsoil contains more sand.

Included with this soil in mapping are small areas of Nunn and Savo soils. These soils make up less than 10 percent of any one mapped area. They contain more clay in the subsoil than the Satanta soil. They are in positions on the landscape similar to those of the Satanta soil.

Fertility is medium and the content of organic matter moderate in the Satanta soil. Available water capacity is moderate or high. Permeability is moderate. Runoff is slow.

Most of the acreage is cropland. This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Some areas are irrigated. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, and needleandthread. Overused areas are dominated by blue grama and sedges.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant moisture supply.

This soil is well suited to building site development and septic tank absorption fields.

The capability unit is IIIc-1; Silty range site.

ScB—Satanta loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces. Areas are irregular in shape and 15 to 90 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown loam about 8 inches thick. The subsoil is about 30 inches of brown, pale brown, and light brownish gray clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous fine sandy loam. In some areas the subsoil contains more sand.

Included with this soil in mapping are small areas of Nunn and Savo soils. These soils make up less than 10 percent of any one mapped area. They contain more clay in the subsoil than the Satanta soil. They are in positions on the landscape similar to those of the Satanta soil.

Fertility is medium and the content of organic matter moderate in the Satanta soil. Available water capacity is moderate or high. Permeability is moderate. Runoff is medium.

Most of the acreage is cropland. This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns. Minimizing tillage and leaving crop residue on the surface conserve moisture. Contour stripcropping, terraces, and grassed waterways help to control erosion.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, and needleandthread. Overused areas are dominated by blue grama and sedges.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion and conserves moisture.

This soil is well suited to most kinds of building site development and to septic tank absorption fields.

The capability unit is IIIe-1; Silty range site.

ScC—Satanta loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces. Areas are irregular in shape and 10 to 60 acres in size. Slopes are smooth.

Typically, the surface layer is grayish brown loam about 8 inches thick. The subsoil is about 32 inches of brown, pale brown, and light brownish gray clay loam and loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous fine sandy loam. In some areas the subsoil contains more sand.

Included with this soil in mapping are small areas of Nunn soils. These soils make up less than 10 percent of any one mapped area. Their subsoil contains more clay

than that of the Satanta soil. Their position on the landscape is similar to that of the Satanta soil.

Fertility is medium and the content of organic matter moderate in the Satanta soil. Available water capacity is moderate or high. Permeability is moderate. Runoff is medium.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, blue grama, and needleandthread. Overused areas are dominated by blue grama and sedges.

This soil is poorly suited to cultivated crops. Controlling erosion and conserving moisture are the main management concerns. Contour stripcropping, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system help to control erosion. Minimizing tillage and leaving crop residue on the surface conserve moisture.

This soil is well suited to most kinds of building site development and to septic tank absorption fields.

The capability unit is IVe-1; Silty range site.

SdA—Savo silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces. Areas are oblong or irregularly shaped and are 15 to 430 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsoil is friable and firm silty clay loam about 16 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light yellowish brown in the lower part. The lower part of the subsoil and the upper part of the underlying material are calcareous and have common accumulations of lime. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous silty clay loam. In some areas the subsoil contains more sand. In places the soil is redder throughout.

Included with this soil in mapping are small areas of Kyle, Manzanola, and Pierre soils. These soils make up less than 10 percent of any one mapped area. Kyle and Pierre soils contain more clay in the subsoil than the Savo soils. The surface layer of Manzanola soils is lighter colored than that of the Savo soil. Kyle soils are on the lower parts of the landscape. Manzanola and Pierre soils are in positions on the landscape similar to those of the Savo soil.

Fertility is medium and the content of organic matter moderate in the Savo soil. Available water capacity is high. Permeability is moderately slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is fairly well suited to cultivated crops. Winter wheat and alfalfa are the main crops. Some areas are irrigated. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, and needlegrasses. Overused areas are dominated by blue grama and sedges.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant moisture supply.

This soil is poorly suited to building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIc-1; Silty range site.

SdB—Savo silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces. Areas are irregular in shape and 15 to 2,100 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsoil is friable and firm silty clay loam about 16 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light yellowish brown in the lower part. The lower part of the subsoil and the upper part of the underlying material are calcareous and have common accumulations of lime. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, calcareous silty clay loam. In some areas the subsoil contains more sand. In places the soil is redder throughout.

Included with this soil in mapping are small areas of Kyle, Manzanola, and Pierre soils. These soils make up less than 10 percent of any one mapped area. Kyle and Pierre soils contain more clay in the subsoil than the Savo soil. The surface layer of Manzanola soils is lighter colored than that of the Savo soil. Kyle soils are on the lower, slightly concave parts of the landscape. Manzanola and Pierre soils are in positions on the landscape similar to those of the Savo soil.

Fertility is medium and the content of organic matter moderate in the Savo soil. Available water capacity is high. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is high.

About half of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass, blue grama, and needlegrasses. Overused areas are dominated by blue grama and sedges.

This soil is fairly well suited to cultivated crops. Alfalfa and winter wheat are the main crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns. Minimizing tillage and

leaving crop residue on the surface conserve moisture. Farming on the contour, terracing, and including grasses and legumes in the cropping system help to control erosion.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil is poorly suited to building site development because of the high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings, however, help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the restricted permeability. Enlarging the absorption area, however, helps to overcome the slow absorption of liquid waste.

The capability unit is IIIe-1; Silty range site.

SmE—Schamber-Eckley complex, 9 to 40 percent slopes. These strongly sloping to steep soils are on high terraces or terrace remnants. The excessively drained Schamber soil is on the steeper ridgetops. The well drained Eckley soil is on the lower, less sloping parts of the landscape. Many small stones and coarse pebbles are on the surface. Areas are irregularly shaped or oblong and are 10 to 220 acres in size. They are 35 to 50 percent Schamber soil and 30 to 45 percent Eckley soil. The two soils occur as areas so closely intermingled that mapping them separately is not practical.

Typically, the surface layer of the Schamber soil is brown, calcareous gravelly loam about 6 inches thick. The upper part of the underlying material is light brown, calcareous gravelly loamy sand. The lower part to a depth of 60 inches is multicolored, calcareous gravelly sand. In some areas the soil contains more loam and less gravel.

Typically, the surface layer of the Eckley soil is grayish brown loam about 4 inches thick. The subsoil is brown, friable clay loam about 8 inches thick. The underlying material to a depth of 60 inches is brown, calcareous gravelly sand. In some areas the gravelly sand is 20 to 40 inches from the surface.

Included with these soils in mapping are small areas of Pierre and Samsil soils on uplands. These included soils make up less than 15 percent of any one mapped area. Pierre soils are underlain by shale 20 to 40 inches from the surface. Samsil soils are underlain by shale 6 to 20 inches from the surface.

Fertility and the content of organic matter are low in the Schamber soil. Fertility is medium and the content of organic matter moderate in the Eckley soil. Available water capacity is low in both soils. Permeability is rapid or very rapid in the Schamber soil. It is moderate in the subsoil of the Eckley soil and rapid in the underlying material. Runoff is medium.

All of the acreage is range. These soils are poorly suited to native grasses, however, because they are droughty. The native vegetation dominantly is blue grama, sedges, and needleandthread. Also, western wheatgrass is common on the Eckley soil. Overused areas are dominated by sedges, blue grama, and weeds. After continued overuse, bare areas are common on the Schamber soil.

These soils are too steep and too droughty for cultivated crops and windbreaks and environmental plantings.

Because it is less sloping, the Eckley soil is better suited to building site development and septic tank absorption fields than the Schamber soil. Land shaping is needed in some areas. Both soils readily absorb the effluent from septic tank absorption fields, but they do not adequately filter the effluent. The poor filtering capacity may result in pollution of ground water. The soils are a probable source of sand and gravel for road construction.

The capability unit is VIIs-7; the Schamber soil is in Very Shallow range site, the Eckley soil in Shallow to Gravel range site.

SnE—Shingle-Penrose-Rock outcrop complex, 15 to 40 percent slopes. This map unit occurs as areas of shallow, well drained, moderately steep and steep soils closely intermingled with areas of Rock outcrop on uplands. The two soils have many small rocks and shale fragments on the surface. They are in a random pattern throughout the map unit. The Rock outcrop occurs mainly as ledges on the higher parts of the landscape. Areas generally are oblong or long and narrow and are 20 to 900 acres in size. They are 50 to 65 percent Shingle soil, 20 to 30 percent Penrose soil, and about 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Shingle soil is light yellowish brown, calcareous loam about 3 inches thick. Below this is a transition layer of light gray, calcareous loam about 5 inches thick. The underlying material is pale yellow, calcareous loam about 9 inches thick. It has common fragments of shale. Pale yellow shale is at a depth of about 17 inches. In places the soil is redder.

Typically, the surface layer of the Penrose soil is light brownish gray, calcareous loam about 4 inches thick. The underlying material is light gray, calcareous loam about 9 inches thick. Hard limestone bedrock is at a depth of about 13 inches. In some areas the soil has a higher content of coarse fragments throughout and has a darker surface layer.

The Rock outcrop is shale intermixed with hard limestone.

Included with the Shingle and Penrose soils and Rock outcrop in mapping are small areas of Midway and Minnequa soils. These included soils make up less than

10 percent of any one mapped area. Midway soils contain more clay throughout than the Penrose and Shingle soils. Their position on the landscape is similar to that of the Penrose and Shingle soils. Minnequa soils are 20 to 40 inches deep over bedrock. They are on the lower parts of the landscape.

Fertility and the content of organic matter are low in the Shingle and Penrose soils. Available water capacity is very low. Permeability is moderate above the bedrock. Runoff is very rapid.

All of the acreage is range. This map unit is fairly well suited to native grasses. The native vegetation dominantly is blue grama, needlegrass, little bluestem, sideoats grama, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because they are too shallow over bedrock and too steep.

The Shingle soil is in capability unit VIIe-4, Shallow range site; the Penrose soil is in capability unit VIIs-1, Shallow range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

SpF—Spearfish-Rock outcrop complex, 9 to 50 percent slopes. This map unit occurs as areas of a shallow, well drained, rolling to very steep Spearfish soil that are closely intermingled with areas of Rock outcrop. It is in areas on uplands where slopes are short and are rough and broken. The Spearfish soil is on the lower, less steep side slopes. The Rock outcrop is on the tops of ridges and the steep or very steep sides of drainageways. Areas are irregular in shape and 20 to 800 acres in size. They are 60 to 75 percent Spearfish soil and 20 to 30 percent Rock outcrop. The Spearfish soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Spearfish soil is reddish brown, calcareous loam about 4 inches thick. Below this is a transition layer of reddish brown, calcareous shaly loam about 4 inches thick. The underlying material is light red, calcareous shaly loam about 9 inches thick. It has many fragments of siltstone. Siltstone bedrock that has layers and lenses of gypsum is at a depth of about 17 inches.

The Rock outcrop is exposed reddish siltstone, sandstone, and shale.

Included with the Spearfish soil and Rock outcrop in mapping are small areas of Nevee and Tilford soils on the lower lying, smooth fans and terraces. These soils make up less than 15 percent of any one mapped area. They are deep. Also, the surface layer of Tilford soils is darker than that of the Spearfish soil.

Fertility and the content of organic matter are low in the Spearfish soil. Available water capacity is very low. Permeability is moderate above the bedrock. Runoff is rapid.

All of the acreage is range. This map unit is poorly suited to native grasses, however, because of the extent of the Rock outcrop (fig. 10). The native vegetation on the Spearfish soil dominantly is little bluestem, prairie sandreed, western wheatgrass, and needleandthread. Many areas support widely scattered ponderosa pine. Overused areas are dominated by needleandthread and sedges. After continued overuse, the extent of bare areas increases.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings, building site development, and septic tank absorption fields because of the shallowness to bedrock, the slope, and the extent of the Rock outcrop.

The Spearfish soil is in capability unit VIIe-7, Shallow range site; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site.

SsE—Spearfish-Tilford extremely stony loams, 6 to 25 percent slopes. These well drained, gently rolling to hilly soils are on uplands. The shallow Spearfish soil is in the steeper areas. The deep Tilford soil is in the less sloping areas. Areas are circular and 5 to 110 acres in size. They are 40 to 55 percent Spearfish soil and 25 to 45 percent Tilford soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Spearfish soil is reddish brown, calcareous extremely stony loam about 4 inches thick. Below this is a transition layer of reddish brown, calcareous shaly loam about 4 inches thick. The underlying material is light red, calcareous shaly loam about 9 inches thick. It has many fragments of siltstone. Light red siltstone bedrock that has layers and lenses of gypsum is at a depth of about 17 inches.

Typically, the surface layer of the Tilford soil is reddish brown extremely stony loam about 4 inches thick. The subsoil is about 14 inches of silty clay loam and calcareous silt loam. It is reddish brown, red, and light red. The underlying material to a depth of 60 inches is red, calcareous silt loam. In some areas the subsoil contains more sand.

Included with these soils in mapping are small areas of Nevee soils. These included soils make up less than 20 percent of any one mapped area. They contain less clay throughout than the Tilford soil. Their position on the landscape is similar to that of the Tilford soil.

Fertility and the content of organic matter are low in the Spearfish soil. Fertility is medium and the content of organic matter moderate in the Tilford soil. Available water capacity is very low in the Spearfish soil and high in the Tilford soil. Permeability is moderate in both soils. Runoff is rapid.

All of the acreage is range. The Spearfish soil is fairly

Figure 10.—Sparse vegetation in an area of Spearfish-Rock outcrop complex, 9 to 50 percent slopes.

well suited and the Tilford soil well suited to native grasses. The native vegetation on the Spearfish soil dominantly is little bluestem, prairie sandreed, and prairie dropseed. That on the Tilford soil dominantly is little bluestem, western wheatgrass, big bluestem, and green needlegrass. Overused areas are dominated by blue grama and sedges.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings. The Spearfish soil is too shallow and too steep, and both soils are too stony.

Because it is deeper and is less steep, the Tilford soil is better suited to building site development than the Spearfish soil. Some land shaping is needed. Also, the stones should be removed from some areas. The Tilford soil is only fairly well suited to septic tank absorption fields because of the stones and the slope. Installing the distribution lines across the slope generally improves the efficiency of the absorption system. In some areas the stones should be removed before the field is installed.

The capability unit is VIIs-6; the Spearfish soil is in Shallow range site, the Tilford soil in Silty range site.

St—Stetter clay. This deep, well drained, nearly level soil is on flood plains along drainageways and creeks that have meandering channels. It is occasionally flooded for brief periods. Areas are long and narrow and 15 to 100 acres in size.

Typically, the surface layer is grayish brown clay about 2 inches thick. The subsurface layer is grayish brown clay about 4 inches thick. The underlying material to a depth of 60 inches is grayish brown and light brownish

gray clay. It is calcareous in the lower part. In some areas the soil contains less clay throughout.

Included with this soil in mapping are small areas of Arvada, Hisle, and Kyle soils. These soils make up less than 10 percent of any one mapped area. Arvada and Hisle soils are slightly higher on the landscape than the Stetter soil. They have a sodium affected subsoil. Also, Hisle soils are 20 to 40 inches deep over shale. Kyle soils are on the higher parts of the landscape. They are not stratified and contain more clay in the subsoil than the Stetter soil.

Fertility and the content of organic matter are low in the Stetter soil. Tilth is poor. Available water capacity is low or moderate. Permeability is slow or very slow. Runoff is slow. The shrink-swell potential is high.

All of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is western wheatgrass and green needlegrass. Overused areas are dominated by blue grama, buffalograss, and weeds.

This soil is poorly suited to cultivated crops. Improving tilth and conserving moisture are the main management concerns. Floodwater delays planting in some years, but in most years the additional moisture is beneficial and the flood damage is minor.

This soil is only fairly well suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum growth is unlikely.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding.

The capability unit is IVs-3; Clayey Overflow range site.

Sw—Swanboy clay. This deep, well drained, nearly level soil is on fans and foot slopes. Areas are irregular in shape and 10 to 90 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray clay about 1 inch thick. The subsoil is grayish brown, firm clay about 14 inches thick. The lower part of the subsoil and the underlying material are calcareous and have accumulations of salts. The underlying material to a depth of 60 inches is grayish brown clay. In some areas the subsoil is sodium affected.

Included with this soil in mapping are some Slickspots, which make up less than 10 percent of any one mapped area. The Slickspots occur as small areas of massive clay. They have a puddled surface and support little or no vegetation.

Fertility and the content of organic matter are low in the Swanboy soil. Tilth is very poor. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

All of the acreage is range. This soil is best suited to native grasses. The native vegetation dominantly is western wheatgrass and green needlegrass. Overused areas are dominated by a thin stand of western wheatgrass and pricklypear.

This soil generally is not suited to cultivated crops and to windbreaks and environmental plantings because of the very poor tilth and the high content of salts in the subsoil.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the very restricted permeability, this soil generally is unsuited to septic tank absorption fields. It is suitable, however, as a site for sewage lagoons.

The capability unit is VIs-6; Dense Clay range site.

TaA—Tilford silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces and uplands. Areas are irregular in shape and 10 to 400 acres in size. Slopes are long and smooth.

Typically, the surface layer is reddish brown silt loam about 4 inches thick. The subsoil is about 14 inches of reddish brown, red, and light red, very friable silty clay loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is red, calcareous silt loam. In some areas carbonates are leached to a depth of 10 inches or more.

Included with this soil in mapping are small areas of Nevee soils. These soils make up less than 10 percent of any one mapped area. They contain less clay between depths of 10 and 40 inches than the Tilford soil. Their position on the landscape is similar to that of the Tilford soil.

Fertility is medium and the content of organic matter moderate in the Tilford soil. Available water capacity is high. Permeability is moderate. Runoff is medium.

About half of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is little bluestem, western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama and sedges.

This soil is well suited to cultivated crops. Alfalfa, forage crops, and small grain are the main crops. Some areas are irrigated. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil is well suited to building site development and septic tank absorption fields.

The capability unit is IIIc-1; Silty range site.

TaB—Tilford silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands. Areas are irregular in shape and 15 to 500 acres in size. Slopes are long and smooth.

Typically, the surface layer is reddish brown silt loam about 4 inches thick. The subsoil is about 14 inches of reddish brown, red, and light red, very friable silty clay loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is red, calcareous silt loam. In some areas carbonates are leached to a depth of 10 inches or more.

Included with this soil in mapping are small areas of Nevee soils. These soils make up less than 10 percent of any one mapped area. They contain less clay between depths of 10 and 40 inches than the Tilford soil. Their position on the landscape is similar to that of the Tilford soil.

Fertility is medium and the content of organic matter moderate in the Tilford soil. Available water capacity is high. Permeability is moderate. Runoff is medium.

About half of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is little bluestem, blue grama, green needlegrass, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

This soil is well suited to cultivated crops. Alfalfa, forage crops, and small grain are the main crops. Some areas are irrigated. Controlling erosion and conserving moisture are the main management concerns. Minimizing tillage and leaving crop residue on the surface conserve moisture. Farming on the contour, terracing, and including grasses and legumes in the cropping system help to control erosion.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion and conserves moisture.

This soil is well suited to building site development and septic tank absorption fields.

The capability unit is IIIe-1; Silty range site.

TaC—Tilford silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces and uplands. Areas are irregular in shape and 10 to 100 acres in size. Slopes are smooth.

Typically, the surface layer is reddish brown silt loam about 4 inches thick. The subsoil is about 14 inches of reddish brown, red, and light red, very friable silty clay loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is red, calcareous silt loam. In some areas carbonates are leached to a depth of 10 inches or more.

Included with this soil in mapping are small areas of Nevee and Spearfish soils. These soils make up less than 10 percent of any one mapped area. Nevee soils contain less clay between depths of 10 and 40 inches than the Tilford soil. Their position on the landscape is similar to that of the Tilford soil. Spearfish soils are underlain by soft siltstone at a depth of 6 to 20 inches. They are on the higher, steeper parts of the landscape.

Fertility is medium and the content of organic matter moderate in the Tilford soil. Available water capacity is high. Permeability is moderate. Runoff is medium.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is little bluestem, blue grama, green needlegrass, and western wheatgrass. Overused areas are dominated by blue grama and sedges.

This soil is fairly well suited to cultivated crops. Alfalfa, forage crops, and small grain are the main crops. Controlling erosion and conserving moisture are the main management concerns. Contour stripcropping, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system help to control erosion. Minimizing tillage and leaving crop residue on the surface conserve moisture.

This soil is well suited to windbreaks and environmental plantings. Planting the trees and shrubs on the contour helps to control erosion and conserves moisture.

This soil is well suited to most kinds of building sites and septic tank absorption fields. Land shaping is needed on some building sites.

The capability unit is IVe-1; Silty range site.

TgC—Tilford-Gystrum complex, 2 to 9 percent slopes. These well drained, gently sloping and moderately sloping soils are in areas on uplands where slopes are long and smooth. The deep Tilford soil is on the lower, less sloping parts of the landscape. The moderately deep Gystrum soil is on the higher, steeper parts. Areas are irregular in shape and 40 to 500 acres in size. They are 35 to 50 percent Tilford soil and 30 to 40 percent Gystrum soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Tilford soil is reddish brown silt loam about 4 inches thick. The subsoil is about 14 inches of reddish brown, red, and light red, very friable silty clay loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is red, calcareous silt loam. In some areas carbonates are leached to a depth of 10 inches or more.

Typically, the surface layer of the Gystrum soil is reddish brown, calcareous silty clay loam about 3 inches thick. The subsoil is light brown, friable, calcareous silty clay loam about 8 inches thick. The underlying material is reddish yellow, calcareous silt loam about 17 inches thick. Gypsum bedrock is at a depth of about 28 inches.

Included with these soils in mapping are small areas of Rekop soils on the tops of small knolls and ridges. These included soils make up less than 15 percent of

any one mapped area. They are underlain by gypsum bedrock at a depth of 10 to 20 inches.

Fertility is medium and the content of organic matter moderate in the Tilford and Gystrum soils. Available water capacity is high in the Tilford soil and low in the Gystrum soil. Permeability is moderate in both soils. Runoff is medium. The shrink-swell potential is moderate in the Gystrum soil.

Most of the acreage is range. The Tilford soil is well suited and the Gystrum soil fairly well suited to native grasses. The native vegetation on the Tilford soil dominantly is little bluestem, green needlegrass, needleandthread, and western wheatgrass. That on the Gystrum soil dominantly is little bluestem, western wheatgrass, needleandthread, and sideoats grama. Overused areas are dominated by blue grama and sedges.

This map unit is poorly suited to cultivated crops. The Tilford soil is suited, but it cannot be farmed separately because it occurs as areas too closely intermingled with areas of the Gystrum soil. Alfalfa and winter wheat are the main crops. Measures that control erosion are the main management needs. Examples are farming on the contour, establishing grassed waterways, and including grasses and legumes in the cropping system.

The Tilford soil is well suited to windbreaks and environmental plantings, but the Gystrum soil generally is unsuited. Windbreaks can be established, but optimum growth and survival are unlikely on the Gystrum soil.

The Tilford soil is better suited to building site development and septic tank absorption fields than the Gystrum soil. The moderate depth to bedrock is the main limitation of the Gystrum soil. Also, the moderate shrink-swell potential is a limitation on building sites.

The Tilford soil is in capability unit IIIe-1, Silty range site; the Gystrum soil is in capability unit VIe-3, Thin Upland range site.

VaE—Valent loamy fine sand, 6 to 25 percent slopes. This deep, excessively drained, gently rolling to hilly soil is on uplands. Areas are irregular in shape and 10 to 1,400 acres in size. Slopes are short and convex. In places they are choppy and dunelike.

Typically, the surface layer is grayish brown loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches is brown loamy fine sand and sand. In some areas lime is within a depth of 40 inches.

Included with this soil in mapping are small areas of Jayem soils on the lower, less sloping parts of the landscape. These soils make up less than 10 percent of any one mapped area. They contain less sand in the subsoil than the Valent soil.

Fertility and the content of organic matter are low in the Valent soil. Available water capacity also is low. Permeability is very rapid. Runoff is slow.

Most of the acreage is range. This soil is well suited to native grasses. The native vegetation dominantly is prairie sandreed and sand bluestem. Overused areas are dominated by blue grama and sand dropseed. After continued overgrazing, the extent of forbs increases and bare areas are common. Wind erosion is a serious problem in the bare areas.

This soil generally is unsuited to cultivated crops and is poorly suited to windbreaks and environmental plantings. Only evergreens and shrubs can be successfully established. Planting the trees and shrubs directly in sod helps to control wind erosion.

This soil is poorly suited to building site development because of the slope. Land leveling is needed in most areas. Because the cut areas are very sandy, revegetating is difficult. Shallow excavations tend to cave in unless they are shored.

Because of the slope and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water. Installing the distribution lines across the slope generally improves the efficiency of the absorption system.

The capability unit is VIIe-3; Sands range site.

WpC—Winler-Pierre clays, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are in areas on uplands where slopes generally are long and smooth. The Winler soil is on the lower side slopes, and the Pierre soil is on the upper convex slopes. When dry, both soils are characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 15 to 160 acres in size. They are 40 to 50 percent Winler soil and 30 to 40 percent Pierre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Winler soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown and olive, very firm clay about 16 inches thick. In the lower part it is calcareous and has accumulations of salts. The underlying material is olive, calcareous shaly clay about 10 inches thick. Gray shale is at a depth of about 30 inches. In some areas the depth to shale is more than 40 inches. In other areas the subsoil does not have visible salts. In places the soil is acid throughout.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is light brownish gray, very firm, calcareous clay about 25 inches thick. It has accumulations of lime in the lower part. The underlying material is brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray shale is at a depth of about 34 inches. In places the soil contains less clay.

Included with these soils in mapping are small areas of Hisle and Samsil soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area.

Hisle soils have a sodium affected subsoil. They are in swales and drainageways. Samsil soils are 6 to 20 inches deep over shale. They are on the higher parts of the landscape and on the shoulders of some drainageways. The Slickspots are in slight depressions. They have no plant cover.

Fertility is low in the Winler soil and medium in the Pierre soil. The content of organic matter is low in both soils. Tilth is very poor in the Winler soil and poor in the Pierre soil. Available water capacity is low in both soils. Permeability is very slow. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage is range. The Pierre soil is well suited to native grasses, but the Winler soil is poorly suited. The native vegetation dominantly is western wheatgrass and green needlegrass. Also, blue grama is common on the Pierre soil. Overused areas of the Winler soil are dominated by a sparse stand of western wheatgrass, pricklypear, and sagebrush. Overused areas of the Pierre soil are dominated by blue grama and buffalograss.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings. The Pierre soil is better suited, but it cannot be managed separately because it occurs as areas too closely intermingled with areas of the Winler soil.

Because of the very high shrink-swell potential, these soils are poorly suited to building site development. The moderate depth to shale also is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the very restricted permeability, these soils generally are unsuited to septic tank absorption fields. They are suitable as sites for sewage lagoons, but the moderate depth to shale is a limitation.

The Winler soil is in capability unit VIs-6, Dense Clay range site; the Pierre soil is in capability unit IVe-3, Clayey range site.

ZnE—Zigweid-Nihill complex, 6 to 20 percent slopes. These deep, gently rolling to hilly soils are in areas on ridges, fans, and terrace escarpments where slopes are short and convex. The well drained Zigweid soil is on the lower parts of the landscape and in saddles between the ridges. The excessively drained Nihill soil is on the ridges and terrace escarpments. In many areas scattered rocks and pebbles are on the surface. Areas are irregular in shape and 10 to 100 acres in size. They are 40 to 50 percent Zigweid soil and 40 to 50 percent Nihill soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Zigweid soil is brown, calcareous clay loam about 6 inches thick. The subsoil is light brownish gray, very friable, calcareous clay loam about 16 inches thick. It has common accumulations of lime in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous loam.

Typically, the surface layer of the Nihill soil is brown, calcareous gravelly loam about 7 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous very gravelly loam. Lime coatings are on the undersides of the pebbles. In some areas the soil has a subsoil in which the content of coarse fragments is less than 35 percent. In other areas hard sandstone bedrock is at a depth of about 30 inches. In places the soil contains more sand between depths of 10 and 40 inches.

Included with these soils in mapping are small areas of Eckley and Samsil soils. These included soils make up less than 15 percent of any one mapped area. Eckley soils are on terraces. Their surface layer is darker than that of either the Nihill or Zigweid soil. Samsil soils contain more clay between depths of 10 and 40 inches than the Nihill and Zigweid soils. They are on uplands.

Fertility and the content of organic matter are low in the Zigweid and Nihill soils. Available water capacity is moderate or high in the Zigweid soil and low in the Nihill soil. Permeability is moderate in the Zigweid soil and moderately rapid in the Nihill soil. Runoff is rapid on both soils. The shrink-swell potential is moderate in the Zigweid soil.

Most of the acreage is range. These soils are fairly well suited to native grasses. The native vegetation dominantly is blue grama, needleandthread, western wheatgrass, and sedges. Overused areas are dominated by blue grama and sedges.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings. The slope of both soils and the droughtiness of the Nihill soil are the main limitations.

These soils are only fairly well suited to most kinds of building site development because of the slope. The moderate shrink-swell potential of the Zigweid soil is an additional limitation. Land shaping is needed in most areas. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability in the Zigweid soil, the Nihill soil is better suited to septic tank absorption fields. Installing the distribution lines across the slope generally improves the functioning of the absorption system.

The Zigweid soil is in capability unit VIe-1, the Nihill soil in capability unit VIe-5; both soils are in Thin Upland range site.

prime farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce economically a sustained high yield of crops.

The prime farmland in Fall River County has an adequate and dependable supply of moisture only where irrigated. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 12,000 acres in Fall River County, or about 1 percent of the total acreage, meets the requirements for prime farmland. All of this acreage is used for irrigated crops, mainly corn and alfalfa.

The map units in irrigated areas that are considered prime farmland are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed soil map units."

The map units that meet the requirements for prime farmland where irrigated are:

AbA—Altvan loam, 0 to 2 percent slopes
AbB—Altvan loam, 2 to 6 percent slopes
AsB—Ascalon fine sandy loam, 0 to 6 percent slopes
Ga—Glenberg fine sandy loam
Ha—Haverson loam
JaB—Jayem fine sandy loam, 2 to 9 percent slopes
Lo—Lohmiller silty clay loam
MtA—Mitchell very fine sandy loam, 0 to 2 percent slopes
MtB—Mitchell very fine sandy loam, 2 to 6 percent slopes
NoA—Norka silt loam, 0 to 2 percent slopes
NoB—Norka silt loam, 2 to 6 percent slopes
NuA—Nunn clay loam, 0 to 2 percent slopes
NuB—Nunn clay loam, 2 to 6 percent slopes
ScA—Satanta loam, 0 to 2 percent slopes
ScB—Satanta loam, 2 to 6 percent slopes
SdA—Savo silt loam, 0 to 2 percent slopes
SdB—Savo silt loam, 2 to 6 percent slopes
TaA—Tilford silt loam, 0 to 2 percent slopes
TaB—Tilford silt loam, 2 to 6 percent slopes

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 8 percent of the acreage in Fall River County is used for cultivated crops or for tame pasture and hay. The major crops are oats, winter wheat, grain sorghum, corn, and alfalfa hay. Corn is grown for grain and silage; oats, wheat, and sorghum for grain; and alfalfa mainly for hay. Alfalfa and intermediate wheatgrass are grown as tame pasture plants. Nearly all of the tame hay is grown in areas where the soil receives some extra moisture, either runoff from adjacent uplands or floodwater.

The potential of the soils in the county for increased crop production is good. About 22,000 acres of potentially good cropland is currently used as range. Food production could be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the county.

Water erosion reduces productivity and results in sedimentation. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Colby soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Altvan soils. When erosion occurs, sediment rich in nutrients enters streams and lakes. Measures that control erosion minimize the pollution of streams and lakes by sediment and preserve water quality for fish and wildlife, recreation, and municipal use. They also reduce the amount of fertilizer needed in cropped areas and prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions reduce the length of slopes and the runoff rate and help to control erosion. They are most practical on deep, well drained soils that have long, smooth slopes. Examples are Norka, Satanta, Savo, and Tilford soils.

Wind erosion is a slight to severe hazard on many of the soils in the county. The hazard is especially severe on Dailey and Dwyer soils. Wind erosion can damage these soils in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. An adequate plant cover, a cover of crop residue, and a rough surface help to control wind erosion. Windbreaks of suitable trees and shrubs also are effective.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in the local offices of the Soil Conservation Service.

Soil fertility helps to determine the yields that can be obtained from the soils. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kinds and amounts of fertilizer needed on Manvel and other soils that have a high content of lime in the surface layer generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts needed.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. In Kyle and Pierre soils, tilth generally is poor. These soils dry out slowly in the spring and cannot be easily tilled when dry. If farmed when wet, they tend to be cloddy when dry. As a result of the cloddiness, preparing a seedbed is difficult. Timely tillage, inclusion of grasses and legumes in the cropping system, and incorporation of crop residue into the soil improve tilth and increase the rate of water intake.

Field crops suited to the soils and climate of the survey area include close-grown crops and row crops. Oats and winter wheat are the main close-grown crops. Sorghum and corn are the main row crops.

Pasture plants best suited to the climate and most of the soils in the survey area include alfalfa, intermediate wheatgrass, and pubescent wheatgrass. Altvan and other droughty soils are suited to crested wheatgrass. Because of the hazard of erosion, bunchgrasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent.

If the pasture is overgrazed, the grasses lose vigor and die and usually are replaced by annual grasses and weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition.

Irrigation generally is limited to the terraces along the Cheyenne River. Flood irrigation is the dominant method in the Angostura Irrigation Project. Sprinkler irrigation is the dominant method outside the project. Corn and alfalfa are the main irrigated crops. The main management concerns if the soils are irrigated are controlling erosion and maintaining good tilth and an adequate level of fertility. Leaving crop residue on the surface helps to control erosion and maintain good tilth. Land leveling for flood irrigation and properly designing contour ditch and corrigation systems help to control erosion and distribute water uniformly. Commercial fertilizers should be applied according to the results of soil tests, the requirements of the crops to be grown, and the yields desired.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops

that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*9*). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 or IVe-4.

The capability classification of each map unit is given in the section "Detailed soil map units".

rangeland

About 83 percent of the acreage of Fall River County is range. Most of the rangeland occurs as large tracts of Boneek, Butche, Dailey, Grummit, Hisle, Kyle, Minnequa, Midway, Pierre, Samsil, Shingle, and Valent soils. About 85 percent of the local farm income is derived from the sale of livestock, principally cattle. Cow-calf enterprises are dominant throughout the county. On a few feedlots and farms, cattle are fed until they are ready for market. On some ranches the forage produced on rangeland is supplemented by crop aftermath. In winter the forage is supplemented by protein concentrate and alfalfa hay.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and

unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of wind and water erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The native vegetation in much of this survey area has been greatly depleted by continued excessive use. The productivity of the range can be increased by applying management that is effective on specific kinds of soils.

An adequate plant cover and ground mulch help to control erosion and increase the moisture supply by reducing the runoff rate. If the range is overgrazed, the more desirable grasses lose vigor and are replaced by less productive short grasses. Managing the range to prevent overgrazing helps to keep the range in good condition. Crossfencing and properly distributing watering facilities help to obtain a uniform distribution of grazing.

woodland management and productivity

Sheridan I. Dronan, forester, Soil Conservation Service, helped prepare this section.

About 70,000 acres of native woodland is in the Black Hills part of the county. Ponderosa pine is the main tree species of commercial value. Other trees common in this area are American elm, Black Hills spruce, bur oak, hophornbeam, and quaking aspen. Narrow strips of deciduous trees are adjacent to the streams outside the Black Hills. Species common in these areas are American elm, bur oak, and plains cottonwood.

The Black Hills part of Fall River County receives less rainfall than most other areas in the Black Hills. This results in a poorer potential for timber production than is typical for the Black Hills. The soils in the Black Hills are used mainly for timber production, woodland wildlife habitat, recreation, and grazing by domestic livestock. Most of the merchantable timber is on the north- and east-facing slopes. The steep slopes and limited access roads restrict logging in these areas. Also, the tracts of merchantable timber are widely scattered.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; 5, low; and 6, very low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in 100 years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

Grazing is detrimental to windbreaks and environmental plantings because the livestock compact the soil and remove the lower branches of the trees and shrubs. The compaction retards growth. Removal of the lower branches reduces the effectiveness of the windbreaks. Weeds and insects prevent maximum growth. Clean cultivation and applications of herbicide help to control the weeds. Summer fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before seedlings can be established. On Ascalon and other soils that are susceptible to soil blowing, the site should be prepared in the spring.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or

no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges and management areas, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are barley, corn, oats, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are alfalfa, intermediate wheatgrass, and yellow sweetclover.

Wild herbaceous plants are native or naturally established grasses, forbs, and sedges. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big and little bluestem, blue grama, common sunflower, switchgrass, threadleaf sedge, and western wheatgrass.

Hardwood trees are planted trees and shrubs that produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of tall trees are American elm, boxelder, bur oak, green ash, hackberry, and plains cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American plum, common chokecherry, crabapple, honeysuckle, cotoneaster, and Russian-olive.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are cedar, juniper, pine, and spruce.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, forbs, and shrubs. These areas produce grain, seed crops, grasses, legumes, and wild herbaceous

plants. The wildlife attracted to these areas include eastern cottontail, field sparrow, western meadowlark, mourning dove, ring-necked pheasant, red fox, white-tailed deer, and white-tailed jackrabbit.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include mule deer, ruffed grouse, squirrels, thrushes, white-tailed deer, and wild turkey.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include lark bunting, mule deer, pronghorn antelope, sharp-tailed grouse, western meadowlark, white-tailed deer, and white-tailed jackrabbit.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made

for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if soluable material is in the soil or bedrock, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in this survey area range from 0.10 to 0.43. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can

be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations generally can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing.

Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series. The soil samples were analyzed by the South Dakota Department of Transportation, Division of Highways.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that is drier than is typical for the great group. An example is Aridic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Aridic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Absted series

The Absted series consists of deep, well drained soils formed in alluvium in drainageways on low terraces and on fans. Permeability is slow. Slopes range from 0 to 2 percent.

Absted soils are similar to Arvada and Hisle soils and commonly are near Arvada, Hisle, Lohmiller, and Stetter soils. Arvada soils have salts within a depth of 16 inches. Their surface layer is thinner than that of the Absted soils. Hisle soils also have a thinner surface layer. They are 20 to 40 inches deep over shale. Lohmiller and

Stetter soils are stratified and do not have a natric horizon. They are in drainageways.

Typical pedon of Absted silt loam, 1,390 feet north and 620 feet west of the southeast corner of sec. 21, T. 8 S., R. 2 E.

A1—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; common very fine roots; neutral; clear wavy boundary.

A2—5 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse granular structure; slightly hard, very friable; few very fine roots; mildly alkaline; abrupt wavy boundary.

B21t—8 to 11 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure; very hard, very firm, sticky and plastic; few very fine roots; mildly alkaline; gradual wavy boundary.

B22t—11 to 17 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; mildly alkaline; gradual wavy boundary.

B3—17 to 24 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; strongly alkaline; gradual wavy boundary.

C1casa—24 to 44 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; hard, firm; few fine accumulations of carbonate and salts; violent effervescence; strongly alkaline; gradual wavy boundary.

C2casa—44 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, firm; common fine accumulations of carbonate and salts; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 14 to 30 inches. The depth to free carbonates ranges from 12 to 20 inches.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The A2 horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2. The A horizon is 4 to 8 inches thick. The B21t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. The B22t horizon has hue of 10YR or 2.5Y and value of 4 or 5 (dry or moist). It is clay or silty clay. The C horizon is silty clay loam or clay. It has few to many fine accumulations of carbonate and salts.

Alice series

The Alice series consists of deep, well drained soils formed in loamy and sandy material on terraces and uplands. Permeability is moderately rapid. Slopes range from 2 to 9 percent.

Alice soils are similar to Jayem soils and commonly are near Ascalon, Dailey, Dwyer, Jayem, and Satanta soils. Ascalon and Satanta soils contain more clay in the subsoil than the Alice soils, and Dailey and Dwyer soils contain less clay between depths of 10 and 40 inches. Free carbonates are leached to a greater depth in the Jayem soils than in the Alice soils. All of the nearby soils are in positions on the landscape similar to those of the Alice soils.

Typical pedon of Alice fine sandy loam, 2 to 9 percent slopes, 1,850 feet east and 1,400 feet north of the southwest corner of sec. 11, T. 10 S., R. 4 E.

A1—0 to 10 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium granular structure; soft, very friable; common very fine and fine roots; neutral; gradual wavy boundary.

B2—10 to 22 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; few fine roots; mildly alkaline; clear wavy boundary.

C1ca—22 to 40 inches; very pale brown (10YR 8/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few fine roots; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—40 to 60 inches; very pale brown (10YR 8/3) loamy very fine sand, brown (10YR 5/3) moist; massive; loose; few very fine roots in the upper part; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 18 to 38 inches. The thickness of the mollic epipedon ranges from 10 to 16 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is very fine sandy loam or loamy fine sand. It is 10 to 16 inches thick. The B horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It is fine sandy loam, very fine sandy loam, or loamy very fine sand.

Altvan series

The Altvan series consists of well drained soils that are moderately deep over gravelly sand. These soils formed in loamy sediment over gravelly sand. They are on terraces. Permeability is moderate above the gravelly sand and very rapid in the gravelly sand. Slopes range from 0 to 6 percent.

Altvan soils are similar to Ascalon and Eckley soils and commonly are near Alice, Ascalon, Eckley, Jayem,

Nunn, and Satanta soils. Eckley soils are 12 to 20 inches deep over gravelly sand. None of the other nearby soils have gravelly sand within a depth of 40 inches. Also, Alice and Jayem soils contain less clay in the subsoil than the Altvan soils.

Typical pedon of Altvan loam, 0 to 2 percent slopes, 1,900 feet north and 1,900 feet east of the southwest corner of sec. 22, T. 7 S., R. 7 E.

A1—0 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common very fine and fine roots; neutral; clear smooth boundary.

B1—6 to 9 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to medium and coarse subangular blocky; slightly hard, very friable; common very fine roots; neutral; clear smooth boundary.

B21t—9 to 12 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak coarse subangular blocky; hard, friable; few very fine roots; mildly alkaline; gradual smooth boundary.

B22t—12 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm; few very fine roots; mildly alkaline; abrupt wavy boundary.

B3ca—17 to 24 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, very friable; many fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C1ca—24 to 33 inches; white (10YR 8/1) loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline; abrupt wavy boundary.

IIC2—33 to 60 inches; very pale brown (10YR 7/3) gravelly sand, brown (10YR 5/3) moist; loose; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 16 to 28 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to the underlying gravelly sand ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). It is 6 to 12 inches thick. The B horizon has hue of 10YR or 7.5YR and value of 5 or 6 (3 or 4 moist). It is loam, clay loam, or sandy clay loam.

Arvada series

The Arvada series consists of deep, well drained soils formed in clayey and loamy alluvium on broad flats, in drainageways, and on alluvial fans. Permeability is very slow. Slopes range from 0 to 2 percent.

Arvada soils are similar to Absted and Hisle soils and commonly are near Absted, Hisle, Lohmiller, Stetter, and Swanboy soils. Absted soils have visible salt crystals below a depth of 16 inches. Their surface layer is thicker than that of the Arvada soils. Hisle soils are 20 to 40 inches deep over shale. Lohmiller, Stetter, and Swanboy soils do not have a natric horizon. Absted and Swanboy soils are in positions on the landscape similar to those of the Arvada soils, Hisle soils are on uplands and terraces, and Lohmiller and Stetter soils are on flood plains.

Typical pedon of Arvada loam, 200 feet west and 500 feet north of the southeast corner of sec. 28, T. 11 S., R. 7 E.

A2—0 to 1 inch; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very thin platy structure parting to very fine granular; soft, very friable; common very fine roots; slight effervescence; neutral; abrupt smooth boundary.

B21t—1 to 5 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium columnar structure parting to moderate medium subangular blocky; extremely hard, firm, sticky and plastic; few very fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

B22t—5 to 14 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, firm, sticky and plastic; few very fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

B3casa—14 to 23 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; few fine accumulations of carbonate and salts; strong effervescence; moderately alkaline; gradual smooth boundary.

Ccasa—23 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; common fine accumulations of carbonate and salts; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 18 to 30 inches. The depth to free carbonates is 0 to 12 inches. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It dominantly is loam but in some pedons is fine sandy loam. It is 1 to 6 inches thick. The B horizon has hue of 10YR or 2.5Y. It is clay or silty clay loam.

Ascalon series

The Ascalon series consists of deep, well drained soils formed in loamy material on uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Ascalon soils are similar to Altvan and Satanta soils and commonly are near Alice, Altvan, Dailey, Dwyer, and Satanta soils. Alice and Dwyer soils contain less clay in the subsoil than the Ascalon soils. Altvan soils are 20 to 40 inches deep over gravelly sand. Dailey soils contain more sand between depths of 10 and 40 inches than the Ascalon soils. Satanta soils have less sand and more silt in the subsoil than the Ascalon soils. All of the nearby soils are in positions on the landscape similar to those of the Ascalon soils.

Typical pedon of Ascalon fine sandy loam, 0 to 6 percent slopes, 600 feet west and 400 feet south of the northeast corner of sec. 24, T. 7 S., R. 8 E.

A1—0 to 3 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; common very fine and fine roots; neutral; clear smooth boundary.

B1—3 to 7 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common very fine and fine roots; neutral; clear smooth boundary.

B21t—7 to 11 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable; common very fine roots; neutral; clear smooth boundary.

B22t—11 to 19 inches; yellowish brown (10YR 5/4) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable; few very fine roots; neutral; gradual wavy boundary.

B3—19 to 27 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; mildly alkaline; gradual wavy boundary.

Cca—27 to 60 inches; light gray (10YR 7/2) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable; common fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to free carbonates ranges from 8 to 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is 3 to 6 inches thick. The B2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4.

Bankard series

The Bankard series consists of deep, somewhat excessively drained soils formed in sandy and loamy alluvium on flood plains. Permeability is rapid. Slopes range from 0 to 2 percent.

Bankard soils are similar to Dwyer and Valent soils and commonly are near Glenberg and Haverson soils. Dwyer and Valent soils are not stratified. They are on uplands. Glenberg and Haverson soils contain less sand between depths of 10 and 40 inches than the Bankard soils. They are higher on the flood plain than the Bankard soils and are farther from the drainageway.

Typical pedon of Bankard fine sandy loam, 2,000 feet south and 1,900 feet west of the northeast corner of sec. 28, T. 7 S., R. 7 E.

A1—0 to 5 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, very friable; common fine and very fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

C—5 to 60 inches; light brownish gray (2.5Y 6/2) loamy sand stratified with thin lenses of sandy loam and sand, grayish brown (2.5Y 5/2) moist; single grain; soft, loose; few fine roots to a depth of 12 inches; strong effervescence; mildly alkaline.

The depth to free carbonates is 0 to 6 inches. The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It is fine sandy loam, loamy fine sand, fine sand, or loam. It is 4 to 8 inches thick. The C horizon has hue of 2.5Y or 10YR.

Barnum series

The Barnum series consists of deep, well drained soils formed in silty and loamy alluvium on low terraces and flood plains along the major streams and drainageways. Permeability is moderate. Slopes range from 0 to 2 percent.

Barnum soils are similar to Haverson soils and commonly are near Haverson, Lohmiller, and Tilford soils. Haverson and Lohmiller soils are on flood plains. They are not so red as the Barnum soils. Also, Lohmiller soils contain more clay between depths of 10 and 40 inches. Tilford soils contain less sand in the subsoil than the Barnum soils and are not stratified. They are on high terraces and uplands.

Typical pedon of Barnum silt loam, 2,050 feet north and 870 feet east of the southwest corner of sec. 3, T. 7 S., R. 1 E.

A1—0 to 5 inches; reddish yellow (5YR 6/5) silt loam, yellowish red (5YR 4/5) moist; weak medium

granular structure; slightly hard, very friable; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C1—5 to 35 inches; reddish yellow (5YR 6/6) silt loam stratified with thin layers of fine sandy loam and very fine sandy loam; yellowish red (5YR 4/6) moist; massive; soft, very friable; common very fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

C2—35 to 60 inches; reddish yellow (5YR 6/6) silt loam, reddish brown (5YR 4/4) moist; massive; soft, very friable; strong effervescence; strongly alkaline.

The A horizon has hue of 7.5YR to 2.5YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 5. It dominantly is silt loam but is loam or very fine sandy loam in some pedons. It is 3 to 6 inches thick. The C horizon is stratified with thin layers of fine sandy loam, silt loam, very fine sandy loam, or silty clay loam.

Boneek series

The Boneek series consists of deep, well drained soils formed in silty and loamy material on uplands. Permeability is moderately slow. Slopes range from 0 to 15 percent.

Boneek soils are similar to Kadoka, Norka, Nunn, and Savo soils and commonly are near Butche, Norka, and Nunn soils. Butche soils are 7 to 20 inches deep over bedrock. They generally are on the steeper, convex parts of the landscape. Kadoka and Norka soils contain less clay in the subsoil than the Boneek soils. Nunn soils contain more fine sand in the subsoil. Savo soils are yellower in the upper part of the subsoil than the Boneek soils.

Typical pedon of Boneek silt loam, 2 to 6 percent slopes, 1,880 feet east and 2,380 feet north of the southwest corner of sec. 2, T. 8 S., R. 3 E.

A1—0 to 6 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium granular structure; slightly hard, friable; common fine and very fine roots; neutral; clear wavy boundary.

B21t—6 to 11 inches; brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few very fine roots; neutral; gradual wavy boundary.

B22t—11 to 15 inches; brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) moist; moderate medium and fine subangular blocky structure; very hard, firm; few very fine roots; neutral; gradual wavy boundary.

B3ca—15 to 23 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm; few very fine roots; few medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1ca—23 to 36 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, friable; many medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C2—36 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 17 to 31 inches. The depth to free carbonates ranges from 11 to 24 inches. The depth to bedrock ranges from 40 to more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It dominantly is silt loam but in some pedons is loam. It is 5 to 8 inches thick. The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. The B3 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is silty clay loam, silt loam, or loam.

Broadhurst series

The Broadhurst series consists of deep, well drained, acid soils formed in clayey alluvium on fans and terraces. When dry, these soils are characterized by cracks 1/2 inch to 2 inches wide, several feet long, and several feet deep. Permeability is very slow. Slopes range from 2 to 15 percent.

Broadhurst soils commonly are near Grummit and Snomo soils. Grummit soils are 6 to 20 inches deep over shale. They generally are steeper than the Broadhurst soils. Snomo soils are not so dense as the Broadhurst soils. They are on the more convex parts of the landscape.

Typical pedon of Broadhurst clay, 2 to 15 percent slopes, 2,450 feet east and 950 feet north of the southwest corner of sec. 23, T. 9 S., R. 6 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak very coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; many cracks 1/2 to 1 inch wide; very strongly acid; clear wavy boundary.

C1—4 to 12 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, sticky and plastic; few very fine roots; many cracks 1/2 to 1 inch wide; very strongly acid; gradual wavy boundary.

C2—12 to 29 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, sticky and plastic; common fine

fragments of shale; many cracks 1/2 to 1 inch wide; extremely acid; gradual wavy boundary.

C3—29 to 50 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; massive; very hard, very firm, sticky and plastic; common fine fragments of shale; extremely acid; gradual wavy boundary.

C4—50 to 60 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, sticky and plastic; few accumulations of gypsum; extremely acid.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. It is 1 to 4 inches thick. The C horizon is extremely acid to medium acid.

Bufton series

The Bufton series consists of deep, well drained soils formed in residuum of clayey shale on uplands. Permeability is slow. Slopes range from 2 to 6 percent.

Bufton soils commonly are near Kadoka, Kyle, Orella, and Pierre soils. Kadoka soils contain less clay in the subsoil than the Bufton soils. They are in positions on the landscape similar to those of the Bufton soils. Kyle soils contain more clay in the subsoil than the Bufton soils. Also, they are lower on the landscape. Orella soils are 10 to 20 inches deep over shale. They are on the steeper, more convex parts of the landscape. Pierre soils contain more clay in the subsoil than the Bufton soils and are underlain by shale at a depth of 20 to 40 inches. They are in positions on the landscape similar to those of the Bufton soils.

Typical pedon of Bufton silty clay loam, 2 to 6 percent slopes, 50 feet west and 1,200 feet south of the northeast corner of sec. 28, T. 10 S., R. 9 E.

A1—0 to 3 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, firm; common very fine roots; neutral; clear smooth boundary.

B21—3 to 5 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm; common very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

B22—5 to 12 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; few very fine roots; violent effervescence; mildly alkaline; clear wavy boundary.

B3ca—12 to 24 inches; light gray (10YR 7/2) silty clay loam, light brownish gray (10YR 6/2) moist; moderate medium and coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm; few very fine roots; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

Cca—24 to 60 inches; very pale brown (10YR 7/3) silty clay loam, light brownish gray (10YR 6/2) moist; weak coarse prismatic structure; very hard, firm; few very fine roots in the upper part; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The depth to free carbonates is 0 to 5 inches. In some pedons the depth to shale is 40 to 60 inches.

The A horizon has value of 4 to 6 (3 or 4 moist). It dominantly is silty clay loam but in some pedons is silty clay. It is 2 to 6 inches thick. The B2 horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3. It is clay loam, silty clay loam, or silty clay.

Butche series

The Butche series consists of shallow, well drained soils formed in material weathered from sandstone on uplands. Permeability is moderate. Slopes range from 3 to 50 percent.

Butche soils are similar to Paunsaugunt and Penrose soils and commonly are near Boneek, Mathias, Norka, and Rockoa soils. Most of the nearby soils are lower on the landscape than the Butche soils, but Mathias soils are on mountains. Boneek soils contain more clay in the subsoil than the Butche soils and are deep. Mathias and Rockoa soils also are deep. The content of coarse fragments is more than 35 percent throughout both of these soils. Norka soils contain less sand in the subsoil than the Butche soils and are deep. Paunsaugunt and Penrose soils contain free carbonates throughout.

Typical pedon of Butche fine sandy loam, in an area of Butche-Boneek complex, 3 to 15 percent slopes, 350 feet south and 1,050 feet west of the northeast corner of sec. 21, T. 8 S., R. 3 E.

A1—0 to 4 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; few very fine roots; slightly acid; clear wavy boundary.

C—4 to 9 inches; light yellowish brown (10YR 6/4) channery fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; slightly hard, very friable; slightly acid; abrupt wavy boundary.

R—9 to 12 inches; very pale brown (10YR 7/4) indurated sandstone, light yellowish brown (10YR 6/4) moist; neutral.

The depth to sandstone ranges from 7 to 20 inches. Stones and coarse fragments of sandstone commonly are on the surface and throughout the A and C horizons.

The A horizon has hue of 10YR or 7.5YR, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is stony loam, channery loam, or loam. It is 2 to 5 inches thick. The content of coarse fragments in the C horizon ranges, by volume, from 10 to 35 percent.

Colby series

The Colby series consists of deep, well drained, calcareous soils formed in silty and loamy material on uplands. Permeability is moderate. Slopes range from 6 to 15 percent.

Colby soils are similar to Manvel, Minnequa, Mitchell, and Nevee soils. Manvel soils have a higher calcium carbonate equivalent between depths of 10 and 40 inches than the Colby soils. Minnequa soils are 20 to 40 inches deep over bedrock. Mitchell soils contain less clay between depths of 10 and 40 inches than the Colby soils. Nevee soils are redder than the Colby soils.

Typical pedon of Colby silt loam, in an area of Colby-Norka silt loams, 6 to 15 percent slopes, 1,650 feet south and 900 feet east of the northwest corner of sec. 3, T. 7 S., R. 8 E.

A1—0 to 4 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable; common fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

AC—4 to 7 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine granular structure; soft, friable; common fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

C1ca—7 to 32 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few fine roots in the upper part; common fine accumulations of carbonate; violent effervescence; mildly alkaline; diffuse wavy boundary.

C2—32 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 3 to 12 inches. Free carbonates are leached to a depth of 6 inches in some pedons.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It dominantly is silt loam but is loam, silty clay loam, or very fine sandy loam in some pedons. It is 3 to 6 inches thick. The AC horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silt loam or loam.

Dailey series

The Dailey series consists of deep, somewhat excessively drained soils formed in sandy material on uplands. Permeability is rapid. Slopes range from 0 to 12 percent.

Dailey soils commonly are near Ascalon, Jayem, and Valent soils. Ascalon and Jayem soils are in positions on the landscape similar to those of the Dailey soils. Ascalon soils contain more clay in the subsoil than the Dailey soils, and Jayem soils contain less sand in the subsoil. Valent soils do not have a mollic epipedon. They are on the higher lying ridges and knolls.

Typical pedon of Dailey fine sand, 6 to 12 percent slopes, 1,500 feet south and 90 feet east of the northwest corner of sec. 5, T. 9 S., R. 8 E.

A11—0 to 9 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; common very fine and fine roots; neutral; clear wavy boundary.

A12—9 to 14 inches; brown (10YR 5/3) fine sand, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable; few very fine roots; neutral; clear smooth boundary.

C1—14 to 27 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; few very fine roots; neutral; clear wavy boundary.

C2—27 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

The solum and the mollic epipedon range from 10 to 17 inches in thickness. The A horizon has value of 4 or 5 (2 or 3 moist). It is 10 to 17 inches thick. It dominantly is fine sand but in some pedons is loamy fine sand. The C horizon is fine sand, loamy fine sand, or sand.

Dwyer series

The Dwyer series consists of deep, somewhat excessively drained soils formed in sandy material on terraces and uplands. Permeability is rapid. Slopes range from 0 to 25 percent.

Dwyer soils are similar to Bankard and Valent soils and commonly are near Alice, Ascalon, and Valent soils. Alice and Ascalon soils have a mollic epipedon and contain more clay in the subsoil than the Dwyer soils. Bankard soils are stratified. They are on flood plains. Valent soils have free carbonates more than 40 inches from the surface. Alice, Ascalon, and Valent soils are in positions on the landscape similar to those of the Dwyer soils.

Typical pedon of Dwyer loamy fine sand, 2 to 6 percent slopes, 300 feet south and 1,870 feet east of the northwest corner of sec. 30, T. 7 S., R. 1 E.

A1—0 to 6 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist;

weak fine granular structure; loose, very friable; common very fine and fine roots; neutral; clear wavy boundary.

C—6 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; single grain; loose, very friable; few very fine roots in the upper part; strong effervescence; moderately alkaline.

Free carbonates are at the surface in some pedons. The A horizon has value of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It is 4 to 8 inches thick. The C horizon has hue of 7.5YR to 2.5Y. It is moderately alkaline or strongly alkaline.

Eckley series

The Eckley series consists of well drained soils that are shallow over gravelly sand. These soils formed in loamy sediments over gravelly sand. They are on terraces. Permeability is moderate in the subsoil and rapid in the underlying material. Slopes range from 0 to 15 percent.

Eckley soils are similar to Altvan soils and commonly are near Altvan, Nihill, Schamber, and Zigweid soils. Altvan soils are underlain by gravelly sand at a depth of 20 to 40 inches. Nihill and Zigweid soils do not have a mollic epipedon or an argillic horizon. Nihill soils are on ridges and terrace escarpments, and Zigweid soils are on uplands and terraces. Schamber soils contain more sand throughout than the Eckley soils. They do not have an argillic horizon. They are in positions on the landscape similar to those of the Eckley soils.

Typical pedon of Eckley loam, in an area of Schamber-Eckley complex, 9 to 40 percent slopes, 2,650 feet east and 880 feet north of the southwest corner of sec. 18, T. 9 S., R. 6 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine roots; neutral; clear wavy boundary.

B21t—4 to 8 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common very fine and fine roots; about 5 percent gravel by volume; neutral; clear smooth boundary.

B22t—8 to 12 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common very fine and fine roots; about 5 percent gravel by volume; neutral; abrupt smooth boundary.

IIC—12 to 60 inches; brown (10YR 5/3) gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; about 40 percent gravel and cobbles by volume; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 20 inches and corresponds to the depth to gravelly sand. The thickness of the mollic epipedon ranges from 7 to 12 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). It is loam or gravelly loam and is 4 to 6 inches thick. The B2t horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is clay loam, gravelly clay loam, or loam. The IIC horizon is gravelly sand or gravelly loamy sand.

Epping series

The Epping series consists of shallow, well drained, calcareous soils formed in material weathered from siltstone on uplands. Permeability is moderate. Slopes range from 6 to 15 percent.

Epping soils are similar to Shingle and Spearfish soils and commonly are near Colby, Kadoka, and Norka soils. Colby soils do not have siltstone bedrock within a depth of 40 inches. They are in positions on the landscape similar to those of the Epping soils. Kadoka and Norka soils have a mollic epipedon. They are deeper than the Epping soils and contain more clay in the subsoil. Also, they are lower on the landscape and generally less sloping. Shingle soils do not contain so much silt as the Epping soils. Spearfish soils are redder than the Epping soils.

Typical pedon of Epping silt loam, in an area of Kadoka-Epping silt loams, 6 to 15 percent slopes, 120 feet north and 120 feet west of the southeast corner of sec. 34, T. 10 S., R. 9 E.

A1—0 to 4 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slight effervescence; neutral; clear smooth boundary.

AC—4 to 11 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

C—11 to 17 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; hard, friable; few fine roots; many siltstone fragments; violent effervescence; mildly alkaline; clear smooth boundary.

Cr—17 to 60 inches; very pale brown (10YR 7/3) siltstone, pale brown (10YR 6/3) moist; massive; violent effervescence; mildly alkaline.

The depth to siltstone bedrock ranges from 10 to 20 inches. The depth to free carbonates is 0 to 6 inches. The A horizon has value of 6 or 7 (3 or 4 moist) and chroma of 2 or 3. The C horizon has value of 6 or 7 (5 or 6 moist).

Glenberg series

The Glenberg series consists of deep, well drained, calcareous soils formed in stratified loamy and silty alluvium on flood plains and low terraces. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Glenberg soils are similar to Haverson soils and commonly are near Bankard and Haverson soils on flood plains. Bankard soils contain more sand between depths of 10 and 40 inches than the Glenberg soils. Haverson soils contain less sand and more silt between depths of 10 and 40 inches.

Typical pedon of Glenberg fine sandy loam, 200 feet east and 1,000 feet north of the southwest corner of sec. 1, T. 7 S., R. 8 E.

A1—0 to 6 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure; slightly hard, very friable; common fine and very fine roots; slight effervescence; moderately alkaline; gradual smooth boundary.

C—6 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam stratified with thin layers of very fine sandy loam, silt loam, and gravelly sandy loam; dark grayish brown (2.5Y 4/2) moist; massive; loose; few very fine roots extending to 36 inches; strong effervescence; moderately alkaline.

The depth to free carbonates is 0 to 6 inches. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is sandy loam. The C horizon has hue of 2.5Y or 10YR, value of 6 or 7 (4 or 5 moist), and chroma of 2 or 3. It is fine sandy loam or sandy loam stratified with silt loam, loamy fine sand, gravelly sandy loam, gravelly loamy sand, very fine sandy loam, and silty clay loam. It is mildly alkaline or moderately alkaline.

Grummit series

The Grummit series consists of shallow, well drained, acid soils formed in material weathered from acid shale on uplands. Permeability is moderate. Slopes range from 3 to 40 percent.

Grummit soils are similar to Orella and Samsil soils and commonly are near Broadhurst, Pierre, and Snomo soils. Broadhurst soils are very firm throughout and are more than 40 inches deep over shale. They are gently sloping to strongly sloping and are on fans and terraces. Orella soils are more dense and more alkaline than the Grummit soils. Pierre and Snomo soils are lower on the landscape than the Grummit soils. Pierre soils are 20 and 40 inches deep over shale and Snomo soils more than 40 inches deep over shale. Samsil soils are calcareous throughout.

Typical pedon of Grummit clay, in an area of Grummit-Rock outcrop complex, 3 to 40 percent slopes, 2,180 feet east and 700 feet north of the southwest corner of sec. 3, T. 10 S., R. 4 E.

A1—0 to 4 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; about 5 percent, by volume, fragments of shale; few fine roots; very strongly acid; clear smooth boundary.

C—4 to 11 inches; grayish brown (10YR 5/2) shaly clay, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; about 40 percent, by volume, fragments of shale; platy rock structure evident; extremely acid; clear smooth boundary.

Cr—11 to 60 inches; light gray (10YR 6/1) shale, dark gray (10YR 4/1) moist; common medium distinct yellowish brown (10YR 5/8) stains; very hard; extremely acid.

The depth to shale ranges from 6 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. It is 2 to 6 inches thick. The C horizon is extremely acid to strongly acid. The content of shale fragments in this horizon ranges, by volume, from 20 to 50 percent.

Gystrum series

The Gystrum series consists of moderately deep, well drained soils formed in silty material weathered from bedrock high in content of gypsum. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 50 percent.

Gystrum soils commonly are near Rekop, Spearfish, and Tilford soils. Rekop and Spearfish soils are in positions on the landscape similar to those of the Gystrum soils. Rekop soils are 10 to 20 inches deep over bedrock. Spearfish soils are 6 to 20 inches deep over bedrock and contain less gypsum throughout than the Gystrum soils. Tilford soils also contain less gypsum throughout. They are more than 40 inches deep over bedrock. They are on the smoother parts of the landscape.

Typical pedon of Gystrum silty clay loam, in an area of Rekop-Tilford-Gystrum complex, 6 to 15 percent slopes, 1,920 feet west and 2,640 feet north of the southeast corner of sec. 6, T. 7 S., R. 4 E.

A1—0 to 3 inches; reddish brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure; soft, very friable; many very fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

B2—3 to 11 inches; light brown (7.5YR 6/3) silty clay loam, brown (7.5YR 5/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few very fine roots; many threads of gypsum; violent effervescence; mildly alkaline; abrupt wavy boundary.

Ccs—11 to 28 inches; reddish yellow (5YR 6/6) silt loam, yellowish red (5YR 4/6) moist; massive; few very fine roots in the upper part; many medium accumulations of gypsum; strong effervescence; mildly alkaline; clear smooth boundary.

Cr—28 to 35 inches; gypsum bedrock.

The thickness of the solum ranges from 8 to 15 inches. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has hue of 7.5YR to 2.5YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4. It is 3 to 6 inches thick. The B2 horizon has hue of 7.5YR to 2.5YR, value of 6 or 7 (5 or 6 moist), and chroma of 3 or 4. The Ccs horizon has hue of 7.5YR to 2.5YR.

Haverson series

The Haverson series consists of deep, well drained, calcareous soils formed in alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Haverson soils are similar to Barnum and Glenberg soils and commonly are near Glenberg and Lohmiller soils. Barnum soils are redder than the Haverson soils. Glenberg soils contain less clay between depths of 10 and 40 inches than the Haverson soils. They are on flood plains and low terraces. Lohmiller soils contain more clay between depths of 10 and 40 inches than the Haverson soils. Also, they are lower on the flood plain.

Typical pedon of Haverson loam (fig. 11), 2,600 feet south and 2,080 feet west of the northeast corner of sec. 18, T. 9 S., R. 7 E.

A1—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, very friable; common fine and very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 36 inches; grayish brown (2.5Y 5/2) loam stratified with silt loam and loamy fine sand; dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; common very fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—36 to 60 inches; grayish brown (2.5Y 5/2) clay loam stratified with fine sandy loam and loamy sand; dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; few very fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

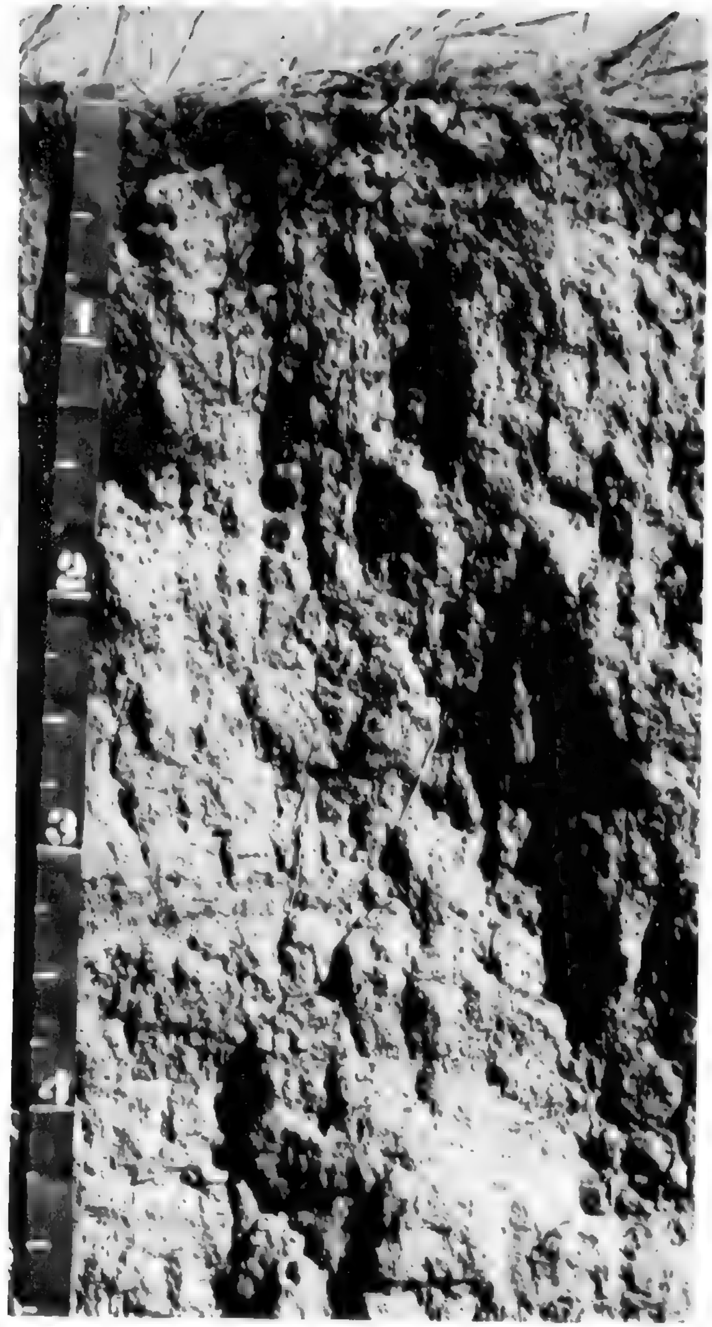

Figure 11.—Profile of Haverson loam. This soil is stratified. Depth is marked in feet.

The depth to free carbonates is 0 to 10 inches. The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It is 4 to 8 inches thick. The C horizon is stratified loamy sand to clay loam. It ranges from about 22 to 30 percent clay.

Haverson Variant

The Haverson Variant consists of deep, well drained soils formed in loamy alluvium on foot slopes. Permeability is moderate. Slopes range from 3 to 9 percent.

Haverson Variant soils are similar to Nihill soils and commonly are near Barnum and Nevee soils. Barnum and Nevee soils do not have stratified gravelly material between depths of 10 and 40 inches. They are in positions on the landscape similar to those of the Haverson Variant soils. Nihill soils are not so stratified or so red in the underlying material as the Haverson Variant soils.

Typical pedon of Haverson Variant loam, 3 to 9 percent slopes, 2,480 feet west and 250 feet south of the northeast corner of sec. 3, T. 7 S., R. 4 E.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, loose; many fine roots; about 15 percent gravel by volume; mildly alkaline; clear smooth boundary.

A12—3 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine granular; soft, loose; few fine roots; about 30 percent gravel and cobblestones by volume; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—6 to 60 inches; reddish brown (5YR 5/3) stratified gravelly sandy loam and loam, reddish brown (5YR 4/3) moist; massive; soft, loose; few fine roots; about 40 percent coarse fragments by volume; strong effervescence; moderately alkaline.

The depth to free carbonates is less than 10 inches. The A horizon has hue of 5YR to 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is 1 to 6 inches thick. The C horizon has hue of 5YR to 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 6. It is moderately alkaline or strongly alkaline.

Hisle series

The Hisle series consists of moderately deep, well drained soils formed in material weathered from shale on uplands and terraces. Permeability is very slow. Slopes range from 0 to 6 percent.

Hisle soils are similar to Arvada and Hoven soils and commonly are near Arvada, Kyle, Stetter, and Swanboy soils. Arvada, Hoven, Kyle, and Swanboy soils are more than 40 inches deep over shale. Also, Kyle and Swanboy soils do not have a natric horizon. Hoven soils are poorly drained and are in depressions. Kyle soils are on alluvial fans and are slightly higher on the landscape than the Hisle soils. Stetter soils are stratified and do not have a natric horizon. They are on flood plains.

Typical pedon of Hisle silt loam, in an area of Hisle-Slickspots complex, 625 feet south and 150 feet west of the northeast corner of sec. 4, T. 9 S., R. 8 E.

A2—0 to 1 inch; light gray (10YR 7/1) silt loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable; common very fine roots; mildly alkaline; abrupt smooth boundary.

B21—1 to 3 inches; pale olive (5Y 6/3) clay, olive (5Y 4/3) moist; weak medium columnar structure parting to moderate fine blocky; hard, firm, sticky and plastic; common fine and very fine roots; few fine accumulations of salts; slight effervescence; mildly alkaline; abrupt wavy boundary.

B22tsa—3 to 10 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and medium accumulations of salts; strong effervescence; moderately alkaline; gradual wavy boundary.

B3sa—10 to 16 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium accumulations of salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C1casa—16 to 20 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; few fine and medium distinct olive yellow (5Y 6/6) mottles; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common medium accumulations of carbonate and salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—20 to 29 inches; light olive gray (5Y 6/2) shaly clay, olive (5Y 5/3) moist; few fine and medium olive yellow (5Y 6/6) mottles; massive; hard, firm, sticky and plastic; few medium accumulations of salts; common shale fragments; slight effervescence in the upper part; moderately alkaline; gradual wavy boundary.

Cr—29 to 60 inches; gray (5Y 6/1) shale, gray (5Y 5/1) moist; few iron stains; mildly alkaline.

The depth to shale ranges from 20 to 40 inches. Free carbonates are at or near the surface. The A2 horizon has value of 5 to 8 (4 or 5 moist). It dominantly is silt loam but in some pedons is loam. The B horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. The C horizon is mildly alkaline to strongly alkaline.

Hoven series

The Hoven series consists of deep, poorly drained soils formed in local alluvium in depressions on uplands. Permeability is very slow. Slopes are less than 1 percent.

Hoven soils commonly are near the well drained Absted, Norka, and Savo soils. They are lower on the landscape than those soils. Norka and Savo soils do not have a natric horizon.

Typical pedon of Hoven silt loam, 2,500 feet south and 100 feet west of the northeast corner of sec. 23, T. 10 S., R. 7 E.

A2—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable; many very fine and fine roots; slightly acid; abrupt wavy boundary.

B21t—2 to 6 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong medium columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; few very fine and fine roots; slightly acid; gradual wavy boundary.

B22t—6 to 19 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; few very fine roots; mildly alkaline; gradual wavy boundary.

B3—19 to 30 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

C—30 to 60 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, friable; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The depth to free carbonates ranges from 14 to 20 inches. The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is 1 to 4 inches thick. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay, silty clay loam, or clay. The C horizon is silty clay loam, silty clay, or clay. Salt crystals and mottles are in some pedons.

Jayem series

The Jayem series consists of deep, well drained soils formed in loamy and sandy eolian material on terraces and uplands. Permeability is moderately rapid. Slopes range from 2 to 9 percent.

Jayem soils are similar to Alice soils and commonly are near Ascalon, Satanta, and Valent soils. Alice soils have free carbonates at a depth of 18 to 38 inches. Ascalon and Satanta soils contain more clay in the subsoil than the Jayem soils. They are in positions on the landscape similar to those of the Jayem soils. Valent soils contain more sand throughout than the Jayem soils. They are on the higher parts of the landscape.

Typical pedon of Jayem fine sandy loam, 2 to 9 percent slopes, 2,550 feet south and 200 feet east of the northwest corner of sec. 1, T. 7 S., R. 9 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; common very fine and fine roots; neutral; abrupt smooth boundary.

A12—6 to 13 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; soft, very friable; few fine roots; neutral; clear smooth boundary.

B2—13 to 30 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; neutral; diffuse smooth boundary.

C—30 to 60 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; neutral.

The thickness of the solum ranges from 15 to 35 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is 7 to 20 inches thick. The B2 horizon has hue of 7.5YR to 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4.

Kadoka series

The Kadoka series consists of moderately deep, well drained soils formed in residuum of siltstone on uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Kadoka soils are similar to Boneek, Norka, and Savo soils and commonly are near Boneek, Epping, and Savo soils. Boneek and Savo soils contain more clay in the subsoil than the Kadoka soils and do not have bedrock within a depth of 40 inches. Epping soils are 10 to 20 inches deep over siltstone bedrock. They are on the steeper parts of the landscape. Norka soils are more than 40 inches deep over siltstone bedrock.

Typical pedon of Kadoka silt loam, in an area of Kadoka-Epping silt loams, 6 to 15 percent slopes, 700 feet north and 80 feet east of the southwest corner of sec. 35, T. 10 S., R. 9 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine granular; soft, friable; common fine roots; neutral; clear wavy boundary.

B21t—4 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2)

moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; common fine roots; neutral; clear wavy boundary.

B22t—9 to 13 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium blocky; hard, firm; few fine roots; neutral; clear wavy boundary.

B3—13 to 21 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; slight effervescence; moderately alkaline; gradual irregular boundary.

Cca—21 to 36 inches; very pale brown (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual irregular boundary.

Cr—36 to 60 inches; very pale brown (10YR 7/3) siltstone, pale brown (10YR 6/3) moist; massive; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 28 inches. The depth to free carbonates ranges from 13 to 25 inches. The depth to bedrock ranges from 25 to 40 inches. The B2 horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. In some pedons the C horizon does not have accumulations of carbonate.

Kyle series

The Kyle series consists of deep, well drained soils formed in clayey material weathered from calcareous shale on uplands and terraces. When dry, these soils are characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 6 percent.

Kyle soils are similar to Pierre soils and commonly are near Hisle, Lohmiller, Pierre, Stetter, and Swanboy soils. Hisle soils have a natric horizon. They are in positions on the landscape similar to those of the Kyle soils. Lohmiller and Stetter soils are stratified and contain less clay between depths of 10 and 40 inches than the Kyle soils. They are on flood plains. Pierre soils are 20 to 40 inches deep over shale. They are on slight rises. Swanboy soils have visible salts within a depth of 15 inches. They are along drainageways.

Typical pedon of Kyle clay, 0 to 2 percent slopes, 450 feet west and 500 feet north of the southeast corner of sec. 12, T. 10 S., R. 8 E.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; 1/4 inch light brownish gray (10YR 6/2) crust at the surface; moderate medium and fine granular structure; hard, firm, sticky and plastic; common fine roots; few cracks 1/2 to 1 inch wide; neutral; clear wavy boundary.

B21—4 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to weak medium and fine blocky; very hard, very firm, sticky and plastic; common fine roots; few cracks 1/2 to 1 inch wide; strong effervescence; mildly alkaline; gradual wavy boundary.

B22—8 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; shiny pressure faces on peds; few fine roots; few cracks 1/2 to 1 inch wide; strong effervescence; mildly alkaline; gradual wavy boundary.

B3—16 to 24 inches; light olive gray (5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure parting to moderate medium and fine blocky; extremely hard, very firm, sticky and plastic; shiny pressure faces on peds; few fine roots; few cracks 1/2 to 1 inch wide; strong effervescence; mildly alkaline; clear wavy boundary.

C1cs—24 to 40 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; weak medium subangular blocky structure in the upper part and massive in the lower part; extremely hard, very firm, sticky and plastic; common fine and medium nests of gypsum; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 60 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate and gypsum; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 18 to 40 inches. The depth to free carbonates is 0 to 6 inches. The depth to shale typically is more than 60 inches, but in some pedons it is 40 to 60 inches.

The A horizon has hue of 2.5Y or 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 to 3. It is 2 to 6 inches thick. The B2 horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. Some pedons do not have a B3 horizon.

Lohmiller series

The Lohmiller series consists of deep, well drained, calcareous soils formed in silty and loamy alluvium on flood plains. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Lohmiller soils are similar to Stetter soils and commonly are near Absted, Arvada, Haverson, Kyle, and Stetter soils. Absted and Arvada soils have a natric horizon. They are in positions on the landscape similar to those of the Lohmiller soils. Haverson soils contain less clay between depths of 10 and 40 inches than the

Lohmiller soils. Also, they are higher on the landscape. Kyle soils contain more clay in the subsoil than the Lohmiller soils and are not stratified. They are on the foot slopes of uplands. Stetter soils contain more clay between depths of 10 and 40 inches than the Lohmiller soils.

Typical pedon of Lohmiller silty clay loam, 550 feet east and 1,180 feet south of the northwest corner of sec. 21, T. 9 S., R. 7 E.

Ap—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; hard, friable; many fine roots; neutral; clear smooth boundary.

A12—4 to 8 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; thin platy structure parting to weak fine granular; very hard, firm; common fine roots; neutral; clear smooth boundary.

C—8 to 60 inches; grayish brown (2.5Y 5/2) clay loam stratified with loam, fine sandy loam, and silty clay loam; dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm; common very fine roots; strong effervescence; mildly alkaline.

The depth to free carbonates is 0 to 10 inches. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It dominantly is silty clay loam and clay loam, but in some pedons it is silty clay. The clay content in this horizon is as low as 35 percent in some pedons and as high as 45 percent in others. The C horizon commonly is stratified with thin layers of loamy sand, fine sandy loam, loam, or silt loam, but it is dominantly silty clay loam, clay loam, or clay.

Manvel series

The Manvel series consists of deep, well drained, calcareous soils formed in silty sediments weathered from limestone. These soils are on foot slopes and alluvial fans. Permeability is moderate. Slopes range from 0 to 2 percent.

Manvel soils are similar to Colby, Minnequa, Mitchell, and Nevee soils and are near those soils. Colby and Minnequa soils have a lower calcium carbonate equivalent between depths of 10 and 40 inches than the Manvel soils. Also, Minnequa soils are 20 to 40 inches deep over bedrock. Mitchell soils are stratified. Nevee soils are redder than the Manvel soils.

Typical pedon of Manvel silt loam, 0 to 2 percent slopes, 920 feet west and 950 feet south of the northeast corner of sec. 22, T. 8 S., R. 1 E.

A1—0 to 5 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

AC—5 to 13 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; violent effervescence; moderately alkaline; diffuse wavy boundary.

C—13 to 60 inches; very pale brown (10YR 7/3) silty clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, very friable; few very fine roots in the upper part; violent effervescence; moderately alkaline.

Free carbonates generally are at the surface, but some pedons are leached to a depth of 4 inches. The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. It dominantly is silt loam, but in some pedons it is silty clay loam.

Manzanola series

The Manzanola series consists of deep, well drained soils formed in alluvium on terraces, fans, and uplands. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Manzanola soils commonly are near Manvel and Savo soils. Manvel soils contain less clay between depths of 10 and 40 inches than the Manzanola soils. They are on foot slopes and alluvial fans. Savo soils have a mollic epipedon. They are on terraces.

Typical pedon of Manzanola silty clay loam, 2 to 6 percent slopes, 1,100 feet south and 750 feet east of the northwest corner of sec. 1, T. 12 S., R. 4 E.

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong fine granular structure; slightly hard, very friable; common very fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

B1—4 to 7 inches; grayish brown (2.5Y 5/2) silty clay loam, olive brown (2.5Y 4/3) moist; moderate medium subangular blocky structure; slightly hard, very friable; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

B2t—7 to 15 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, firm; few very fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

B3cs—15 to 25 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; hard, firm; few very fine roots; common fine accumulations of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

Ccs—25 to 60 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive;

slightly hard, friable; common fine accumulations of gypsum; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates is 0 to 8 inches.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is 4 to 7 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It dominantly is silty clay, but in some pedons it is silty clay loam. In some pedons the C horizon does not have accumulations of gypsum.

Mathias series

The Mathias series consists of deep, well drained soils formed in colluvial sediments weathered from interbedded sandstone and shale on mountains. Permeability is moderate. Slopes range from 15 to 70 percent.

Mathias soils are similar to Rockoa and Vanocker soils and commonly are near Butche, Midway, and Rockoa soils. Butche soils have indurated sandstone within a depth of 20 inches. They are on the tops and upper sides of steep ridges. Midway soils have shale within a depth of 20 inches and do not have fragments of rock throughout. They are in positions on the landscape similar to those of the Mathias soils. Rockoa soils are frigid. They are on north- and east-facing slopes. Vanocker soils have an argillic horizon.

Typical pedon of Mathias extremely stony very fine sandy loam, in an area of Rock outcrop-Mathias-Butche complex, 30 to 75 percent slopes, 200 feet east and 1,050 feet south of the northwest corner of sec. 26, T. 7 S., R. 3 E.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) extremely stony very fine sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, very friable; many fine and medium roots; neutral; clear smooth boundary.

A12—2 to 9 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, very friable; many fine and medium roots; about 40 percent, by volume, stones, boulders, and coarse fragments of rock; neutral; gradual wavy boundary.

A2—9 to 13 inches; brown (7.5YR 5/2) very fine sandy loam, dark brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; common fine roots; about 40 percent, by volume, stones, boulders, and coarse fragments of rock; neutral; clear wavy boundary.

B21t—13 to 20 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, friable; pink (7.5YR 7/4) coatings on faces of some peds when dry; few fine roots; about 45 percent, by volume, stones, boulders, and coarse fragments of rock; neutral; clear wavy boundary.

B22t—20 to 28 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; about 50 percent, by volume, stones, boulders, and coarse fragments of rock; neutral; gradual wavy boundary.

B3—28 to 33 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few fine roots; about 50 percent, by volume, stones, boulders, and coarse fragments of rock; mildly alkaline; gradual wavy boundary.

C—33 to 60 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; hard, friable; few fine roots; about 55 percent, by volume, stones and coarse fragments of rock; mildly alkaline.

The thickness of the solum ranges from 20 to 60 inches. Some pedons have free carbonates below a depth of 40 inches. The content of stones, boulders, and coarse rock fragments ranges, by volume, from 35 to 65 percent in the solum and from 40 to 75 percent in the C horizon.

The A horizon has hue of 7.5YR or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It is 5 to 25 inches thick. It dominantly is extremely stony or very stony fine sandy loam and very fine sandy loam but in some pedons is extremely stony or very stony sandy loam or loam. It ranges from slightly acid to mildly alkaline. The B2t horizon has hue of 5YR to 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 6. It is fine sandy loam, very fine sandy loam, sandy clay loam, or loam. It ranges from slightly acid to mildly alkaline. The C horizon is fine sandy loam, sandy loam, or sandy clay loam. It ranges from neutral to moderately alkaline. Sandstone, shale, or limestone is below a depth of 40 inches in some pedons.

Midway series

The Midway series consists of shallow, well drained, calcareous soils formed in silty material weathered from calcareous shale on uplands. Permeability is slow. Slopes range from 6 to 25 percent.

Midway soils are similar to Samsil soils and commonly are near Mathias, Minnequa, and Shingle soils. The deep Mathias soils are on mountains. Their content of coarse fragments is more than 35 percent throughout. Minnequa soils are 20 to 40 inches deep over bedrock. They are gently sloping to moderately steep. Samsil soils contain more clay throughout than the Midway soils. They are in positions on the landscape similar to those of the Midway soils. Shingle soils contain less clay throughout than the Midway soils. Also, they generally are steeper.

Typical pedon of Midway silty clay loam, in an area of Minnequa-Midway silty clay loams, 6 to 25 percent

slopes, 2,000 feet west and 580 feet south of the northeast corner of sec. 13, T. 12 S., R. 4 E.

A1—0 to 4 inches; pale olive (5Y 6/3) silty clay loam, olive (5Y 4/3) moist; weak fine granular structure; hard, friable; common fine roots; strong effervescence; mildly alkaline; clear wavy boundary.
AC—4 to 8 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive (5Y 5/4) moist; weak medium subangular blocky structure; hard, firm; few fine accumulations of carbonate; few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.
C—8 to 16 inches; olive (5Y 5/3) silty clay loam, olive (5Y 4/3) moist; hard, firm; few fine roots; common medium shale fragments; bedding planes evident; few fine accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.
Cr—16 to 60 inches; pale yellow (5Y 7/3) shale, olive (5Y 5/3) moist; few fine faint reddish stains; very hard; slight effervescence; moderately alkaline.

The depth to shale ranges from 6 to 20 inches. The A horizon has hue of 10YR to 5Y, value of 3 to 6 (3 to 5 moist), and chroma of 2 or 3. The C horizon is silty clay loam, clay, or silty clay.

Minnequa series

The Minnequa series consists of moderately deep, well drained, calcareous soils formed in silty material weathered from limestone on uplands. Permeability is moderate. Slopes range from 2 to 25 percent.

Minnequa soils are similar to Colby and Manvel soils and commonly are near Manvel, Midway, and Penrose soils. Colby and Manvel soils are more than 40 inches deep over bedrock. Midway and Penrose soils generally are on the steeper parts of the landscape. Midway soils contain more clay throughout than the Minnequa soils and have shale within a depth of 20 inches. Penrose soils contain more sand throughout than the Minnequa soils and have limestone within a depth of 20 inches.

Typical pedon of Minnequa silty clay loam, in an area of Minnequa-Midway silty clay loams, 6 to 25 percent slopes, 2,000 feet east and 1,700 feet north of the southwest corner of sec. 6, T. 7 S., R. 7 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable; common fine roots; strong effervescence; mildly alkaline; clear smooth boundary.
AC—4 to 11 inches; light grayish brown (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, very friable; common fine roots; violent effervescence; mildly alkaline; clear smooth boundary.
C—11 to 24 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable; common fine roots to 18 inches; violent effervescence; mildly alkaline; abrupt smooth boundary.
Cr—24 to 60 inches; light gray (10YR 7/1) limestone, grayish brown (10YR 5/2) moist; few fine roots in the upper part; mildly alkaline.

The depth to limestone ranges from 20 to 40 inches. The A horizon has hue of 5Y to 7.5YR, value of 5 to 8 (3 to 7 moist), and chroma of 1 to 4. It dominantly is silty clay loam, but in some pedons it is silt loam, loam, or clay loam.

Mitchell series

The Mitchell series consists of deep, well drained, calcareous soils formed in colluvial and alluvial sediments weathered from siltstone on terraces and colluvial slopes. Permeability is moderate. Slopes range from 0 to 6 percent.

Mitchell soils are similar to Colby and Nevee soils and commonly are near Alice and Colby soils. Alice soils are on terraces. Their subsoil contains more sand than that of the Mitchell soils. Colby soils contain more clay throughout than the Mitchell soils. Also, they are higher on the landscape. Nevee soils are redder than the Mitchell soils.

Typical pedon of Mitchell very fine sandy loam, 2 to 6 percent slopes, 840 feet west and 2,000 feet north of the southeast corner of sec. 26, T. 8 S., R. 2 E.

Ap—0 to 7 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium granular structure; slightly hard, very friable; common very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
A12—7 to 11 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure; slightly hard, very friable; common very fine roots; slight effervescence; mildly alkaline; diffuse smooth boundary.
AC—11 to 18 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure; slightly hard, very friable; few very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
C1—18 to 28 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure; soft, very friable; few very fine roots; strong effervescence; mildly alkaline; diffuse smooth boundary.

C2—28 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; few very fine roots; violent effervescence; moderately alkaline.

The depth to free carbonates is 0 to 5 inches. The A horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It dominantly is very fine sandy loam but in some pedons is loam or silt loam.

Nevee series

The Nevee series consists of deep, well drained soils on terraces, alluvial fans, and uplands. These soils formed in silty alluvium weathered from reddish siltstone or silty shale. Permeability is moderate. Slopes range from 6 to 15 percent.

Nevee soils are similar to Colby, Manvel, and Mitchell soils and commonly are near Spearfish and Tilford soils. Colby, Manvel, and Mitchell soils are not so red as the Nevee soils. Spearfish soils are 10 to 20 inches deep over siltstone. They are on the higher parts of the landscape. Tilford soils contain more clay in the subsoil than the Nevee soils. They are in positions on the landscape similar to those of the Nevee soils.

Typical pedon of Nevee silt loam, 6 to 15 percent slopes, 1,450 feet west and 2,600 feet north of the southeast corner of sec. 9, T. 7 S., R. 3 E.

A11—0 to 3 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; common fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

A12—3 to 8 inches; yellowish red (5YR 5/6) silt loam, reddish brown (5YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; common fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C—8 to 43 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; common very fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—43 to 60 inches; yellowish red (5YR 5/6) siltstone, yellowish red (5YR 4/6) moist; very hard, friable; strong effervescence; moderately alkaline.

The depth to free carbonates is 0 to 10 inches. The depth to siltstone or silty shale is more than 40 inches. The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 3 to 6. It is 4 to 10 inches thick. The C horizon has hue of 2.5YR to 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 4 to 6.

Nihill series

The Nihill series consists of excessively drained soils that are very shallow over loamy and gravelly sediments. These soils formed in loamy and gravelly deposits on ridges and terrace escarpments. Permeability is moderately rapid. Slopes range from 6 to 20 percent.

Nihill soils are similar to Haverson Variant and Schamber soils and commonly are near Eckley, Schamber, and Zigweid soils. The nearby soils are in positions on the landscape similar to those of the Nihill soils. Haverson Variant soils are stratified between depths of 10 and 40 inches. Eckley soils have a mollic epipedon and an argillic horizon. Schamber soils contain more sand throughout than the Nihill soils. The content of coarse fragments in the subsoil of Zigweid soils is less than 35 percent.

Typical pedon of Nihill gravelly loam, in an area of Zigweid-Nihill complex, 6 to 20 percent slopes, 1,690 feet north and 100 feet east of the southwest corner of sec. 16, T. 10 S., R. 7 E.

A1—0 to 7 inches; brown (10YR 5/3) gravelly loam, dark grayish brown (10YR 4/2) moist; weak coarse granular structure; soft, very friable; common fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

Cca—7 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly loam, grayish brown (2.5Y 5/2) moist; massive; loose; few very fine roots in the upper 5 inches; few fine accumulations of carbonate on the underside of pebbles; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is 6 to 10 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4. It is very gravelly loam, very gravelly sandy loam, or very gravelly clay loam. The content of gravel in this horizon is 50 to 70 percent.

Norka series

The Norka series consists of deep, well drained soils formed in eolian deposits on high terraces and uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Norka soils are similar to Boneek, Kadoka, and Savo soils and commonly are near Boneek, Colby, and Savo soils. Boneek and Savo soils contain more clay in the subsoil than the Norka soils. Colby soils do not have a mollic epipedon or an argillic horizon. They are on the higher parts of the landscape. Kadoka soils are 20 to 40 inches deep over bedrock.

Typical pedon of Norka silt loam, 6 to 9 percent slopes, 300 feet north and 700 feet west of the southeast corner of sec. 28, T. 10 S., R. 9 E.

A1—0 to 4 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak very fine granular structure; slightly hard, very friable; common fine roots; neutral; clear smooth boundary.
B1—4 to 7 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common fine roots; neutral; clear smooth boundary.
B2t—7 to 12 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; neutral; clear smooth boundary.
B3ca—12 to 15 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; few fine roots; few medium and fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.
Cca—15 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; few fine roots in the upper part; few medium and fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 25 inches. The depth to free carbonates ranges from 6 to 15 inches. The thickness of the mollic epipedon ranges from 8 to 15 inches.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is 3 to 5 inches thick. The B2t horizon has hue of 7.5YR to 2.5Y, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 6. It is silty clay loam, silt loam, loam, or clay loam.

Nunn series

The Nunn series consists of deep, well drained soils formed in loamy sediments on terraces and uplands. Permeability is slow or moderately slow. Slopes range from 0 to 9 percent.

Nunn soils are similar to Boneek and Savo soils and commonly are near those soils and Satanta soils. Boneek and Savo soils contain less sand in the subsoil than the Nunn soils. Satanta soils contain less clay in the subsoil. They are on terraces.

Typical pedon of Nunn clay loam, 0 to 2 percent slopes, 800 feet west and 250 feet north of the southeast corner of sec. 26, T. 7 S., R. 7 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common fine and very fine roots; neutral; clear smooth boundary.
B1—5 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, friable; common very fine roots; neutral; clear smooth boundary.
B2t—8 to 18 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and very plastic; few very fine roots; neutral; gradual smooth boundary.
B3ca—18 to 25 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; very hard, firm; few very fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.
C1ca—25 to 36 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.
C2ca—36 to 47 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.
C3—47 to 60 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 16 to 30 inches. The depth to free carbonates ranges from 10 to 25 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is 4 to 8 inches thick. The B2t horizon has hue of 7.5YR to 2.5Y, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. Some pedons have a buried A horizon.

Orella series

The Orella series consists of shallow, well drained soils formed in residuum of clayey shale on uplands. Permeability is very slow. Slopes range from 6 to 30 percent.

Orella soils are similar to Grummit and Samsil soils and commonly are near Bufton, Epping, and Samsil soils. Bufton soils are more than 40 inches deep over shale. They are on the lower parts of the landscape. Epping soils contain less clay throughout than the Orella soils. They are in positions on the landscape similar to those of the Orella soils. Grummit and Samsil soils are not so dense as the Orella soils. Also, Grummit soils are acid.

Typical pedon of Orella silty clay, in an area of Orella-Rock outcrop complex, 6 to 40 percent slopes, 700 feet south and 2,400 feet west of the northeast corner of sec. 28, T. 10 S., R. 9 E.

A1—0 to 2 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, firm; common very fine and fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

AC—2 to 12 inches; light gray (2.5Y 7/2) clay, grayish brown (2.5Y 5/2) moist; moderate medium and fine blocky structure; very hard, very firm, sticky and plastic; few very fine roots; many shale fragments; strong effervescence; mildly alkaline; clear smooth boundary.

C—12 to 18 inches; light gray (2.5Y 7/2) clay, grayish brown (2.5Y 5/2) moist; moderate medium blocky structure; very hard, very firm, sticky and plastic; many fine shale fragments; moderately alkaline; strong effervescence; gradual smooth boundary.

Cr—18 to 60 inches; white (2.5Y 8/2) shale, light gray (2.5Y 7/2) moist; massive; hard, firm, sticky and plastic; slight effervescence; mildly alkaline.

The depth to free carbonates is 0 to 15 inches. The depth to shale ranges from 10 to 20 inches. The A horizon has hue of 10YR or 2.5Y, value of 6 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay, clay loam, or clay. The AC and C horizons are clay or clay loam.

Paunsaugunt series

The Paunsaugunt series consists of shallow, well drained soils on mountains. These soils formed in residuum of limestone and calcareous sandstone. Permeability is moderate above the bedrock. Slopes range from 9 to 60 percent.

Paunsaugunt soils are similar to Butche and Penrose soils and commonly are near Penrose and Vanocker soils. Butche soils are not calcareous. Penrose soils do not have a mollic epipedon. Vanocker soils are more than 40 inches deep over bedrock. They are on the colluvial side slopes below the Paunsaugunt soils.

Typical pedon of Paunsaugunt gravelly loam, in an area of Paunsaugunt-Vanocker-Rock outcrop complex, 9 to 60 percent slopes, 70 feet west and 1,245 feet south of the northeast corner of sec. 28, T. 7 S., R. 5 E.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

A12—3 to 8 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable; common fine roots; about 35 percent coarse fragments; violent effervescence; mildly alkaline; clear diffuse boundary.

C—8 to 14 inches; light brownish gray (10YR 6/2) channery loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable; few fine roots; about 40 percent coarse fragments; violent effervescence; mildly alkaline; abrupt wavy boundary.

R—14 to 20 inches; hard limestone bedrock.

The thickness of the mollic epipedon ranges from 5 to 12 inches. The depth to bedrock ranges from 10 to 20 inches. The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is 3 to 12 inches thick. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. The content of coarse fragments in this horizon is 35 to 50 percent.

Penrose series

The Penrose series consists of shallow, well drained, calcareous soils formed in residuum of limestone and interbedded limy shale on uplands. Permeability is moderate. Slopes range from 15 to 40 percent.

Penrose soils are similar to Butche and Paunsaugunt soils and commonly are near Paunsaugunt and Shingle soils. Butche soils are not calcareous. Paunsaugunt soils have a mollic epipedon. Their content of coarse fragments is more than 35 percent between depths of 10 and 20 inches. Shingle soils are 10 to 20 inches deep over soft bedrock. They are in positions on the landscape similar to those of the Penrose soils.

Typical pedon of Penrose loam, in an area of Shingle-Penrose-Rock outcrop complex, 15 to 40 percent slopes, 970 feet north and 1,300 feet west of the southeast corner of sec. 15, T. 8 S., R. 1 E.

A1—0 to 4 inches; light brownish gray (10YR 6/2) loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; common very fine roots; few small fragments of rock; strong effervescence; moderately alkaline; clear wavy boundary.

C—4 to 13 inches; light gray (10YR 7/2) loam, yellowish brown (10YR 5/4) moist; massive; soft, friable; few very fine roots; about 15 percent, by volume, rock fragments; violent effervescence; moderately alkaline; abrupt smooth boundary.

R—13 to 37 inches; white (10YR 8/1) hard limestone bedrock occurring as ledges 2 to 4 inches thick and separated by thin bands of shale.

The depth to hard bedrock ranges from 10 to 20 inches. The A horizon has hue of 2.5Y to 7.5YR, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 4. It is 2 to 6 inches thick.

Pierre series

The Pierre series consists of moderately deep, well drained soils formed in clayey material weathered from shale on uplands. When dry, these soils are characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 2 to 25 percent.

Pierre soils are similar to Kyle soils and commonly are near Grummit, Kyle, Samsil, Swanboy, and Winler soils. Grummit and Samsil soils have shale within a depth of 20 inches. They generally are on the steeper slopes. Kyle and Swanboy soils are more than 40 inches deep over shale. Also, Swanboy soils are on alluvial fans and foot slopes. Winler soils have visible salts within a depth of 17 inches. They are in positions on the landscape similar to those of the Pierre soils.

Typical pedon of Pierre clay, in an area of Pierre-Samsil clays, 6 to 25 percent slopes, 1,020 feet west and 1,930 feet north of the southeast corner of sec. 21, T. 11 S., R. 9 E.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and plastic; many fine and very fine roots; few cracks 1/2 to 1 inch wide; neutral; abrupt smooth boundary.

B2—4 to 20 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, sticky and plastic; few very fine roots; few cracks 1/2 to 1 inch wide; slight effervescence; mildly alkaline; gradual wavy boundary.

B3ca—20 to 29 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak coarse and medium subangular blocky structure; very hard, very firm, sticky and plastic; few cracks 1/2 to 1 inch wide; many medium accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

Cca—29 to 34 inches; light brownish gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; about 30 to 50 percent, by volume, shale fragments; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear smooth boundary.

Cr—34 to 60 inches; light brownish gray (2.5Y 6/2) shale, grayish brown (2.5Y 5/2) moist; slight effervescence; neutral.

The thickness of the solum ranges from 15 to 31 inches. The depth to free carbonates is 0 to 4 inches. The depth to shale ranges from 20 to 40 inches.

The A horizon has hue of 10YR to 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. The B2 horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. Some pedons do not have a B3ca horizon. In some pedons gypsum and other salts are in the seams of the Cr horizon.

Rekop series

The Rekop series consists of shallow, well drained soils formed in residuum of gypsum bedrock on uplands. Permeability is moderate. Slopes range from 6 to 15 percent.

Rekop soils commonly are near Gystrum, Spearfish, and Tilford soils. Gystrum soils are 20 to 40 inches deep over gypsum bedrock. They are below the Rekop soils on the landscape. Spearfish soils do not contain so much gypsum above the bedrock as the Rekop soils. They are in positions on the landscape similar to those of the Rekop soils. Tilford soils have a mollic epipedon and do not have bedrock within a depth of 40 inches. They are on the smoother, lower parts of the landscape.

Typical pedon of Rekop loam, in an area of Rekop-Tilford-Gystrum complex, 6 to 15 percent slopes, 1,830 feet north and 1,070 feet east of the southwest corner of sec. 10, T. 7 S., R. 4 E.

A1—0 to 4 inches; light reddish brown (5YR 6/4) loam, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

Ccs—4 to 15 inches; pink (7.5YR 8/4) loam, light brown (7.5YR 6/4) moist; massive; soft, very friable; few fine roots in the upper part; common fine accumulations of carbonate and gypsum; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—15 to 60 inches; gypsum bedrock; slight effervescence; mildly alkaline.

The depth to gypsum bedrock ranges from 10 to 20 inches. The A horizon has hue of 10YR to 5YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is 3 to 6 inches thick. The C horizon has hue of 7.5YR to 2.5YR.

Rockoa series

The Rockoa series consists of deep, well drained soils formed in material weathered from interbedded sandstone and shale on uplands. Many stones, boulders, and fragments of rock are on the surface and throughout the profile. Permeability is moderate. Slopes range from 25 to 60 percent.

Rockoa soils are similar to Mathias soils and commonly are near Butche and Mathias soils. Butche soils are underlain by hard sandstone within a depth of 20 inches. They are on the higher parts of the landscape. Mathias soils are warmer than the Rockoa soils. They generally are on south- and west-facing slopes.

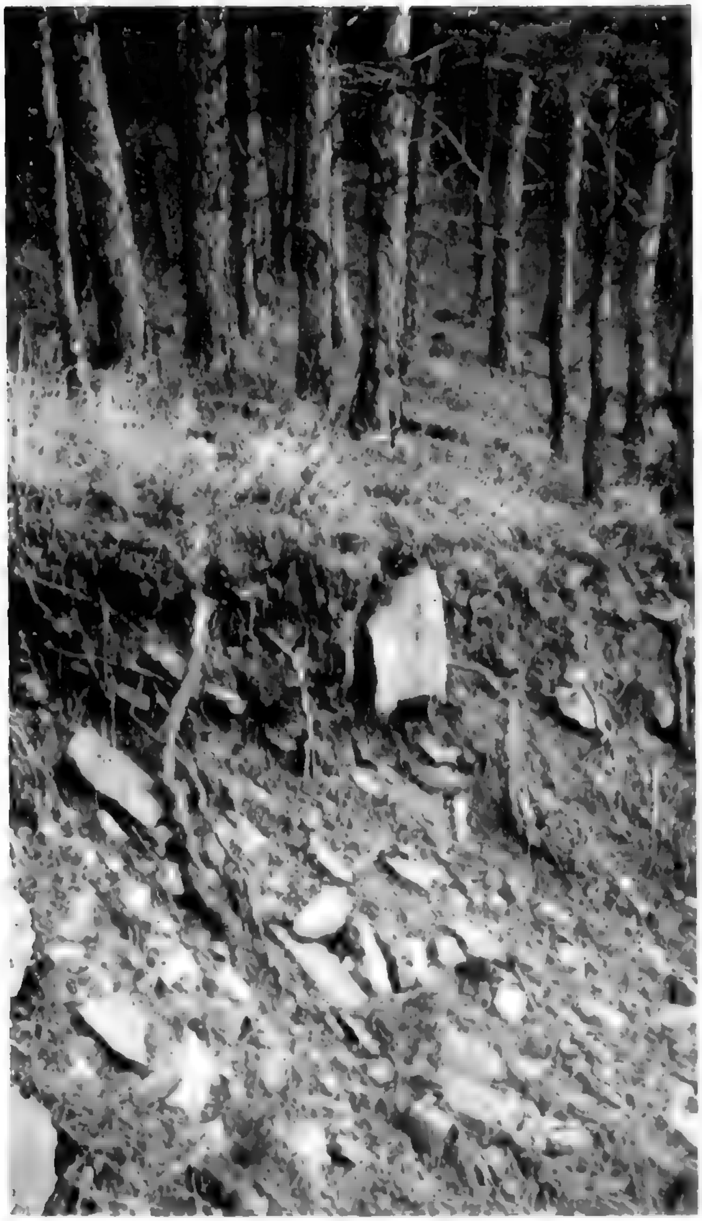

Figure 12.—Profile of Rockoa extremely stony fine sandy loam.

Typical pedon of Rockoa extremely stony fine sandy loam, in an area of Rockoa-Rock outcrop complex, 25 to 60 percent slopes (fig. 12), 160 feet east and 2,570 feet south of the northwest corner of sec. 25, T. 7 S., R. 4 E.

O—1 inch to 0; partly decomposed leaves and roots; neutral; abrupt wavy boundary.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) extremely stony fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to fine and medium granular; soft, very friable; few fine to coarse roots; slightly acid; abrupt wavy boundary.

A2—5 to 10 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; few fine roots; about 30 percent, by volume, stones and fragments of rock; slightly acid; clear wavy boundary.

B&A—10 to 15 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist (B2t); pinkish gray (7.5YR 7/2), brown (7.5YR 5/4) moist (A2); moderate fine and medium subangular blocky structure; slightly hard, firm; few fine roots; about 35 percent, by volume, stones and fragments of rock; slightly acid; clear wavy boundary.

B21t—15 to 21 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; few fine to coarse roots; about 40 percent, by volume, stones and fragments of rock; slightly acid; gradual wavy boundary.

B22t—21 to 32 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; strong medium subangular blocky structure; hard, firm; few fine to coarse roots; about 40 percent, by volume, stones and fragments of rock; neutral; gradual wavy boundary.

B3—32 to 51 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, friable; few fine to coarse roots; about 45 percent, by volume, stones and fragments of rock; neutral; gradual wavy boundary.

C—51 to 60 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; massive; hard, friable; few fine to coarse roots; about 50 percent, by volume, stones and fragments of rock; neutral.

The thickness of the solum ranges from 20 to 60 inches. Many rock fragments ranging in size from pebbles to boulders about 6 feet in diameter are on the surface and throughout the profile. They make up, by volume, 35 to 55 percent of the B horizon and 40 to 70 percent of the C horizon.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is slightly acid or neutral. The A2 horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It ranges from medium acid to neutral. The B2t horizon has hue of 5YR to 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 3 to 6. It ranges from medium acid to neutral. Some pedons do not have a B3 horizon. The C horizon is fine sandy loam or sandy clay loam. It ranges from medium acid to neutral.

Samsil series

The Samsil series consists of shallow, well drained, calcareous soils formed in residuum of shale on uplands. Permeability is slow. Slopes range from 6 to 40 percent.

Samsil soils are similar to Grummit, Midway, and Orella soils and commonly are near Midway, Pierre, and Schamber soils. Grummit soils are acid. Midway soils contain less clay throughout than the Samsil soils. Orella soils are not so friable as the Samsil soils. Pierre soils are 20 to 40 inches deep over shale. They are lower on the landscape than the Samsil soils. Schamber soils have gravelly sand within a depth of 20 inches. They are in positions on the landscape similar to those of the Samsil soils.

Typical pedon of Samsil clay, in an area of Pierre-Samsil clays, 6 to 25 percent slopes, 1,220 feet west and 1,830 feet north of the southeast corner of sec. 21, T. 11 S., R. 9 E.

A1—0 to 3 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and plastic; many fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

AC—3 to 8 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure parting to weak medium granular; hard, friable, sticky and plastic; common fine roots; few medium fragments of shale; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—8 to 14 inches; light brownish gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; few fine roots; about 25 percent, by volume, fine and medium fragments of shale; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C2ca—14 to 18 inches; light gray (2.5Y 7/2) shaly clay, grayish brown (2.5Y 5/2) moist; massive; bedding planes evident; hard, friable, sticky and plastic; few fine roots along the bedding planes; about 50 percent, by volume, fragments of shale; few fine accumulations of carbonate; slight effervescence; moderately alkaline; abrupt smooth boundary.

Cr—18 to 60 inches; light gray (2.5Y 7/2) shale, grayish brown (2.5Y 5/2) moist; very hard; few iron and manganese stains; slight effervescence; mildly alkaline.

The depth to shale ranges from 6 to 20 inches. The A horizon has hue of 5Y to 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It is 2 to 4 inches thick. The clay content above the shale ranges from 45 to 65 percent.

Satanta series

The Satanta series consists of deep, well drained soils formed in loamy sediments on terraces. Permeability is moderate. Slopes range from 0 to 9 percent.

Satanta soils are similar to Ascalon soils and commonly are near Altvan, Ascalon, Nunn, and Savo soils. Altvan soils have gravelly sand 20 to 40 inches from the surface. Ascalon soils contain more sand in the subsoil than the Satanta soils. Nunn and Savo soils contain more clay in the subsoil than the Satanta soils. All of the nearby soils are in positions on the landscape similar to those of the Satanta soils.

Typical pedon of Satanta loam, 2 to 6 percent slopes, 2,400 feet west and 2,080 feet south of the northeast corner of sec. 36, T. 8 S., R. 6 E.

A1—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common very fine roots; neutral; gradual smooth boundary.

B21t—8 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate coarse and very coarse subangular blocky structure parting to moderate fine subangular blocky; hard, friable; common very fine roots; neutral; gradual wavy boundary.

B22t—15 to 20 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

B3ca—20 to 38 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; few very fine roots; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—38 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 15 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). It dominantly is loam, but in some pedons it is fine sandy loam. It is 6 to 10 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. It is clay loam or loam.

Savo series

The Savo series consists of deep, well drained soils formed in silty and clayey sediments on terraces.

Permeability is moderately slow. Slopes range from 0 to 6 percent.

Savo soils are similar to Boneek, Kadoka, and Nunn soils and commonly are near Manzanola, Norka, and Nunn soils. Boneek soils are redder than the Savo soils. Kadoka and Norka soils contain less clay in the subsoil than the Savo soils. Also, Kadoka soils are 20 to 40 inches deep over siltstone bedrock. Manzanola soils do not have a mollic epipedon. Nunn soils contain more sand in the subsoil than the Savo soils. Manzanola and Norka soils are in positions on the landscape similar to those of the Savo soils.

Typical pedon of Savo silt loam, 0 to 2 percent slopes, 1,200 feet west and 300 feet south of the northeast corner of sec. 16, T. 10 S., R. 8 E.

A1—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; common fine and very fine roots; slightly acid; clear wavy boundary.

B21t—5 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable; common very fine roots; slightly acid; clear wavy boundary.

B22t—9 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm; few very fine roots; neutral; clear wavy boundary.

B3ca—16 to 21 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; moderate coarse subangular blocky structure parting to moderate fine subangular blocky; very hard, firm; few very fine roots; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—21 to 42 inches; pale yellow (2.5Y 7/3) silty clay loam; light olive brown (2.5Y 5/3) moist; massive; very hard, firm; common fine accumulations of carbonate; violent effervescence; mildly alkaline; diffuse wavy boundary.

C2—42 to 60 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; massive; very hard, firm; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 15 to 28 inches. The depth to free carbonates ranges from 12 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 15 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is 3 to 9 inches thick. The B22t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is silty clay loam, silty clay, clay loam, or clay. The clay content in this horizon dominantly is 35 to 45 percent but ranges from 35 to 50 percent.

Schamber series

The Schamber series consists of excessively drained soils that are very shallow over gravelly material. These soils formed in gravelly deposits on terraces. Permeability is rapid or very rapid. Slopes range from 9 to 40 percent.

Schamber soils are similar to Nihill soils and commonly are near Eckley, Nihill, Samsil, and Zigweid soils. Eckley soils have a mollic epipedon and an argillic horizon. Nihill and Zigweid soils contain more clay and less sand throughout than the Schamber soils. Samsil soils also contain more clay throughout and have shale within a depth of 20 inches. All of the nearby soils are in positions on the landscape similar to those of the Schamber soils.

Typical pedon of Schamber gravelly loam, in an area of Schamber-Eckley complex, 9 to 40 percent slopes, 800 feet east and 100 feet north of the southwest corner of sec. 34, T. 7 S., R. 6 E.

A11—0 to 2 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; many fine and very fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

A12—2 to 6 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; many very fine roots; about 25 percent, by volume, rounded, lime coated gravel and cobblestones; strong effervescence; moderately alkaline; clear wavy boundary.

C1ca—6 to 19 inches; light brown (7.5YR 6/4) gravelly loamy sand, brown (7.5YR 4/4) moist; single grain; loose; few roots to a depth of 15 inches; about 50 percent, by volume, gravel and cobblestones; few fine accumulations of carbonate; coatings of carbonate on the undersides of the gravel; strong effervescence; moderately alkaline; gradual smooth boundary.

C2ca—19 to 60 inches; multicolored gravelly sand; single grain; loose; few coatings of carbonate on the undersides of the gravel; strong effervescence; moderately alkaline.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is gravelly loam or gravelly sandy loam. The C horizon is gravelly sand, gravelly loamy sand, and very gravelly sand.

Shingle series

The Shingle series consists of shallow, well drained, calcareous soils formed in residuum of soft shale or interbedded sandstone and shale on uplands. Permeability is moderate. Slopes range from 15 to 40 percent.

Shingle soils are similar to Epping and Spearfish soils and commonly are near Midway, Minnequa, and Penrose soils. Epping soils contain more silt than the Shingle soils. Midway soils contain more clay throughout than the Shingle soils. Minnequa soils are 20 to 40 inches deep over limestone. Penrose soils are 10 to 20 inches deep over hard limestone. Spearfish soils are redder than the Shingle soils. Midway and Penrose soils are in positions on the landscape similar to those of the Shingle soils. Minnequa soils are on the less sloping parts of the landscape.

Typical pedon of Shingle loam, in an area of Shingle-Penrose-Rock outcrop complex, 15 to 40 percent slopes, 1,270 feet north and 1,020 feet west of the southeast corner of sec. 25, T. 9 S., R. 2 E.

A1—0 to 3 inches; light yellowish brown (2.5Y 6/4) loam, grayish brown (2.5Y 5/2) moist; moderate very fine granular structure; slightly hard, very friable; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

AC—3 to 8 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

C—8 to 17 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable; few very fine roots; common shale fragments; violent effervescence; moderately alkaline; diffuse wavy boundary.

Cr—17 to 60 inches; pale yellow (2.5Y 7/4) shale, light olive brown (2.5Y 5/4) moist; moderately alkaline.

The depth to shale ranges from 10 to 20 inches. The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. It is 3 to 6 inches thick. The C horizon has thin strata of sandstone below a depth of 20 inches in some pedons. The shale bedrock is not leached of carbonates in some pedons.

Snomo series

The Snomo series consists of deep, well drained, acid soils formed in clayey material weathered from acid shale on uplands. Permeability is moderate. Slopes range from 3 to 15 percent.

Snomo soils commonly are near Broadhurst and Grummit soils. Broadhurst soils are not so friable as the Snomo soils. They are on fans and terraces. Grummit soils have shale within a depth of 20 inches. They are on the steeper parts of the landscape.

Typical pedon of Snomo clay, in an area of Grummit-Snomo clays, 3 to 15 percent slopes, 2,330 feet east and 800 feet north of the southwest corner of sec. 3, T. 10 S., R. 4 E.

A1—0 to 7 inches; light brownish gray (10YR 6/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable, sticky and plastic; few very fine roots; extremely acid; clear smooth boundary.

B21—7 to 21 inches; pale brown (10YR 6/3) clay, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; few very fine roots; extremely acid; diffuse smooth boundary.

B22—21 to 38 inches; pale brown (10YR 6/3) clay, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; extremely acid; diffuse smooth boundary.

C1—38 to 45 inches; pale brown (10YR 6/3) clay, brown (10YR 4/3) moist; few fine distinct brownish yellow (10YR 6/6) stains; weak coarse subangular blocky structure; hard, friable, sticky and plastic; extremely acid; diffuse smooth boundary.

C2—45 to 60 inches; light brownish gray (10YR 6/2) shaly clay, grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/8) stains; massive; hard, friable, sticky and plastic; about 20 percent, by volume, weathered shale fragments; bedding planes evident; extremely acid.

The thickness of the solum ranges from 24 to 58 inches. The depth to shale ranges from 40 to more than 60 inches. The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay. It is 4 to 8 inches thick. The B2 horizon has hue of 7.5YR to 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. Some pedons have a B3 horizon.

Spearfish series

The Spearfish series consists of shallow, well drained soils formed in residuum of reddish sandstone, siltstone, or shale on uplands. Permeability is moderate. Slopes range from 9 to 40 percent.

Spearfish soils are similar to Epping and Shingle soils and commonly are near Nevee and Tilford soils. Epping and Shingle soils are not so red as the Spearfish soils. Nevee and Tilford soils are on smooth fans and terraces below the Spearfish soils. They are more than 40 inches deep over bedrock. Also, Tilford soils have a mollic epipedon.

Typical pedon of the Spearfish loam, in an area of Spearfish-Rock outcrop complex, 9 to 50 percent slopes,

1,300 feet west and 1,320 feet south of the northeast corner of sec. 10, T. 7 S., R. 3 E.

A1—0 to 4 inches; reddish brown (2.5YR 5/4) loam, reddish brown (2.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; few very fine roots; strong effervescence; mildly alkaline; clear smooth boundary.
AC—4 to 8 inches; reddish brown (2.5YR 5/4) shaly loam, reddish brown (2.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable; few very fine roots; many fine fragments of siltstone 2 to 10 millimeters in size; strong effervescence; mildly alkaline; gradual smooth boundary.
C1—8 to 17 inches; light red (2.5YR 6/6) shaly loam, red (2.5YR 4/6) moist; massive; hard, firm; many medium fragments of siltstone 10 to 20 millimeters in size; rock structure evident; violent effervescence; mildly alkaline; abrupt wavy boundary.
Cr—17 to 25 inches; light red (2.5YR 6/6) siltstone, red (2.5YR 4/6) moist; common thin layers and lenses of gypsum; slight effervescence; mildly alkaline.

The depth to bedrock ranges from 6 to 20 inches. The A horizon has hue of 2.5YR to 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is 2 to 5 inches thick. It is loam or extremely stony loam. The C horizon has hue of 2.5YR to 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 4 to 6.

Stetter series

The Stetter series consists of deep, well drained soils formed in clayey alluvium on flood plains. These soils are characterized by cracks, which are 1/2 inch to 2 inches wide, several feet long, and several feet deep. Permeability is slow or very slow. Slopes range from 0 to 2 percent.

Stetter soils are similar to Lohmiller soils and commonly are near Absted, Arvada, Hisle, Kyle, Lohmiller, and Swanboy soils. Absted, Arvada, and Hisle soils have a natric horizon. Kyle and Swanboy soils contain more clay in the subsoil than the Stetter soils and are not stratified. Lohmiller soils contain less clay between depths of 10 and 40 inches than the Stetter soils. Absted, Arvada, Hisle, Kyle, and Swanboy soils are on terraces and fans.

Typical pedon of Stetter clay, 400 feet west and 640 feet north of the southeast corner of sec. 16, T. 12 S., R. 6 E.

A11—0 to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak thick platy structure parting to weak very fine granular; hard, firm, sticky and plastic; common fine and very fine roots; few cracks 1/2 to 1 inch wide; neutral; clear wavy boundary.
A12—2 to 6 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few cracks 1/2 to 1 inch wide; mildly alkaline; clear wavy boundary.
C1—6 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few cracks 1/2 to 1 inch wide; thin multicolored strata; mildly alkaline; gradual wavy boundary.
C2—16 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; few very fine roots; thin multicolored strata; slight effervescence; mildly alkaline.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 1 or 2. It is 2 to 6 inches thick. The C horizon is clay stratified with thin layers of loam, clay loam, sandy clay loam, or sandy clay. Some pedons have a buried A horizon.

Swanboy series

The Swanboy series consists of deep, well drained soils formed in clayey alluvium on fans and foot slopes. When dry, these soils are characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 3 percent.

Swanboy soils are similar to Winler soils and commonly are near Hisle, Kyle, Pierre, Stetter, and Winler soils. Hisle and Kyle soils are on uplands and terraces. Hisle soils have a natric horizon. Kyle soils do not have visible salts within a depth of 15 inches. Pierre soils are not so dense as the Swanboy soils and are 20 to 40 inches deep over shale. They are on uplands. Stetter soils contain less clay between depths of 10 and 40 inches than the Swanboy soils and are stratified. They are on flood plains along drainageways. Winler soils are 20 to 40 inches deep over shale.

Typical pedon of Swanboy clay, 800 feet south and 140 feet east of the northwest corner of sec. 21, T. 10 S., R. 9 E.

A1—0 to 1 inch; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few cracks 1 to 2 inches wide; moderately alkaline; abrupt smooth boundary.
B21—1 to 6 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/3) moist; moderate medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; few cracks 1

to 2 inches wide; moderately alkaline; clear smooth boundary.

B22sa—6 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/3) moist; weak coarse subangular blocky structure; extremely hard, firm, sticky and plastic; common fine accumulations of salts; few cracks 1/2 to 1 inch wide; slight effervescence; moderately alkaline; clear smooth boundary.

Ccssa—15 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/3) moist; massive; hard, firm, sticky and plastic; many fine accumulations of salts; few cracks 1/2 to 1 inch wide in the upper 25 inches; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 24 inches. Free carbonates are within a few inches of the surface.

The A horizon has hue of 2.5Y or 5Y and value of 6 or 7 (5 moist). It is 1/2 inch to 2 inches thick. The B horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3.

Tilford series

The Tilford series consists of deep, well drained soils formed in red, silty residuum of shale on terraces and uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Tilford soils are near Gystrum, Nevee, Rekop, and Spearfish soils. Gystrum soils are 20 to 40 inches deep over gypsum bedrock. Nevee soils contain less clay between depths of 10 and 40 inches than the Tilford soils. Rekop and Spearfish soils do not have a mollic epipedon. Gystrum, Rekop, and Spearfish soils are higher on the landscape than the Tilford soils. Nevee soils are in positions on the landscape similar to those of the Tilford soils.

Typical pedon of Tilford silt loam, 2 to 6 percent slopes, 1,800 feet east and 2,010 feet north of the southwest corner of sec. 5, T. 7 S., R. 3 E.

A1—0 to 4 inches; reddish brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; slightly hard, very friable; common very fine roots; neutral; clear wavy boundary.

B21—4 to 9 inches; reddish brown (2.5YR 4/3) silty clay loam, dark reddish brown (2.5YR 3/3) moist; weak coarse prismatic structure parting to weak medium and fine subangular blocky; hard, very friable; few very fine roots; mildly alkaline; gradual wavy boundary.

B22—9 to 14 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very friable; few very fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

B3—14 to 18 inches; light red (2.5YR 6/6) silt loam, red (2.5YR 4/6) moist; weak coarse subangular blocky structure; hard, very friable; few very fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.

C—18 to 60 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; massive; slightly hard, very friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 13 to 31 inches. The depth to free carbonates is 0 to 10 inches. The thickness of the mollic epipedon ranges from 7 to 15 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is silt loam or extremely stony loam. It is 3 to 6 inches thick. The B2 horizon has hue of 2.5YR to 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 3 to 6. It is silt loam or silty clay loam. In some pedons the C horizon has few to common accumulations of gypsum. Silty shale is at a depth of 40 to 60 inches in some pedons.

Valent series

The Valent series consists of deep, excessively drained soils formed in sandy eolian deposits on uplands. Permeability is very rapid. Slopes range from 6 to 25 percent.

Valent soils are similar to Dwyer soils and commonly are near Dailey, Dwyer, and Jayem soils. Dailey and Jayem soils are on the lower parts of the landscape. They have a mollic epipedon. Also, Jayem soils contain less sand in the subsoil than the Valent soils. Dwyer soils are calcareous within a few inches of the surface.

Typical pedon of Valent loamy fine sand, 6 to 25 percent slopes, 60 feet north and 660 feet west of the southeast corner of sec. 16, T. 9 S., R. 7 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; common fine roots; neutral; clear smooth boundary.

C1—4 to 7 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak very coarse granular structure; soft, very friable; few very fine roots; neutral; gradual wavy boundary.

C2—7 to 60 inches; brown (10YR 5/3) sand, dark brown (10YR 4/3) moist; single grain; loose; neutral.

The thickness of the solum ranges from 3 to 10 inches. The depth to free carbonates ranges from 40 to more than 60 inches. The C horizon has hue of 2.5Y to 7.5YR. It is sand, fine sand, or loamy fine sand.

Vanocker series

The Vanocker series consists of deep, well drained soils formed in colluvial material weathered from limestone and calcareous sandstone. These soils are on mountains. Permeability is moderate. Slopes range from 15 to 60 percent.

The Vanocker soils in this county are taxadjuncts to the Vanocker series because they have free calcium carbonate at the surface. This difference, however, does not alter the use or behavior of the soils.

Vanocker soils are similar to Mathias and Rockoa soils and commonly are near Paunsaugunt soils. Mathias and Rockoa soils have an argillic horizon. Paunsaugunt soils are 10 to 20 inches deep over hard limestone. They are higher on the landscape than the Vanocker soils.

Typical pedon of Vanocker gravelly loam, in an area of Paunsaugunt-Vanocker-Rock outcrop complex, 9 to 60 percent slopes, 300 feet west and 1,500 feet south of the northeast corner of sec. 21, T. 7 S., R. 5 E.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; slightly hard, very friable; many medium and coarse roots; strong effervescence; mildly alkaline; clear wavy boundary.

B21—3 to 5 inches; brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 4/2) moist; moderate medium and fine subangular blocky structure; slightly hard, very friable; few medium and coarse roots; about 25 percent, by volume, fragments of rock; strong effervescence; mildly alkaline; clear wavy boundary.

B22—5 to 17 inches; brown (7.5YR 5/4) channery loam, dark brown (7.5YR 4/4) moist; moderate medium and fine subangular blocky structure; slightly hard, very friable; few medium and coarse roots in the upper part; about 40 percent, by volume, fragments of rock; violent effervescence; mildly alkaline; diffuse wavy boundary.

C—17 to 60 inches; light yellowish brown (10YR 6/4) channery loam, dark yellowish brown (10YR 4/4) moist; massive; about 50 percent, by volume, fragments of rock; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 10 to 25 inches. The depth to free carbonates is 0 to 15 inches. The content of limestone or sandstone fragments increases with increasing depth. It ranges from 15 to 25 percent in the A horizon and from 40 to 80 percent in the lower part of the C horizon. The depth to bedrock ranges from 40 to more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 to 4 moist), and chroma of 1 to 3. It is 1 to 4 inches thick. It dominantly is gravelly loam, but in some pedons it is loam. It is neutral or mildly alkaline. The B2 horizon has hue of 7.5YR or 5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is gravelly loam, channery loam, very channery loam, or clay loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR to 2.5YR.

Winler series

The Winler series consists of moderately deep, well drained soils formed in clayey residuum of shale on uplands. When dry, these soils are characterized by cracks, which are 1/2 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 2 to 9 percent.

Winler soils are similar to Swanboy soils and commonly are near Hisle, Kyle, Pierre, and Swanboy soils. Hisle soils have a natric horizon. They are on uplands and terraces. Kyle and Swanboy soils are more than 40 inches deep over shale. Kyle soils are on uplands and terraces, and Swanboy soils are on alluvial fans and foot slopes. Pierre soils are in positions on the landscape similar to those of the Winler soils. Their subsoil has a lower content of salts than that of the Winler soils.

Typical pedon of Winler clay, in an area of Winler-Pierre clays, 2 to 9 percent slopes, 600 feet east and 270 feet north of the southwest corner of sec. 5, T. 9 S., R. 9 E.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure in the upper part and moderate medium subangular blocky structure in the lower part; very hard, very firm, sticky and plastic; common very fine roots; few cracks 1 to 2 inches wide; neutral; clear wavy boundary.

B2—4 to 11 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few cracks 1 to 2 inches wide; mildly alkaline; gradual wavy boundary.

B3sacs—11 to 20 inches; olive (5Y 5/3) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few cracks 1/2 to 1 inch wide; common fine accumulations of gypsum and other salts; slight effervescence; mildly alkaline; gradual wavy boundary.

C—20 to 30 inches; olive (5Y 5/3) shaly clay, olive (5Y 4/3) moist; few fine distinct light olive brown (2.5Y 5/6) stains, brownish yellow (10YR 6/6) moist; massive; very hard, very firm, very sticky and very plastic; few cracks 1/2 to 1 inch wide; slight effervescence; mildly alkaline; distinct wavy boundary.

Cr—30 to 60 inches; gray (5Y 5/1) shale, very dark gray (5Y 3/1) moist; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 13 to 27 inches. The depth to accumulations of gypsum and other salts ranges from 8 to 17 inches. The depth to shale ranges from 20 to 40 inches.

The A horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is 2 to 5 inches thick. The B2 horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3.

Zigweid series

The Zigweid series consists of deep, well drained soils formed in calcareous, loamy sediments. These soils are on uplands and terrace escarpments. Permeability is moderate. Slopes range from 6 to 20 percent.

Zigweid soils commonly are near Eckley, Nihill, and Schamber soils. Eckley soils have a mollic epipedon and an argillic horizon. In the part of Nihill soils between depths of 10 and 40 inches, the content of coarse fragments is more than 35 percent. Schamber soils have gravelly sand within a depth of 20 inches. All of the nearby soils are in positions on the landscape similar to those of the Zigweid soils.

Typical pedon of Zigweid clay loam, in an area of Zigweid-Nihill complex, 6 to 20 percent slopes, 1,620 feet north and 60 feet east of the southwest corner of sec. 16, T. 10 S., R. 7 E.

A1—0 to 6 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, very friable; common fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

B2—6 to 15 inches; light brownish gray (2.5Y 6/3) clay loam, grayish brown (2.5Y 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; few fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

B3ca—15 to 22 inches; light brownish gray (2.5Y 6/3) clay loam, grayish brown (2.5Y 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cca—22 to 60 inches; light gray (2.5Y 7/3) loam, grayish brown (2.5Y 5/3) moist; massive; slightly hard, very friable; few fine accumulations of carbonate; few fine pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. Free carbonates are within a few inches of the surface. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It dominantly is clay loam, but in some pedons it is loam. It is 4 to 8 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. It is clay loam or loam.

formation of the soils

Soil forms when soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Fall River County.

climate

Climate directly affects the rate of chemical and physical weathering. Fall River County has a continental climate, which generally is characterized by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. It also favors a moderately slow rate of weathering or soil formation. The higher elevations in the Black Hills receive slightly more precipitation than the other parts of the county. Climatic differences between the west- and south-facing slopes and the north- and east-facing slopes in the Black Hills account for some of the differences among the soils in the county. Detailed information about the climate is given under the heading "General nature of the county."

plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Fall River County the prairie grasses have had more influence than other living organisms on soil formation. The gently sloping Norka soils contain more organic matter than the more sloping Colby soils because they have a more extensive grass cover. As a result, they release more plant nutrients. Earthworms, insects, and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

parent material

Many of the soils in Fall River County formed in residuum of clayey shale, silty shale, sandstone, siltstone, and limestone. Some formed in alluvium and in loess deposits. The parent material affects many of the chemical and physical characteristics of the soil, for example, color, texture, reaction, and consistence.

Shallow soils and limestone outcrops of the Minnekahta Formation are prevalent at the higher elevations in the Black Hills (*4*). The shallow Paunsaugunt soils formed in residuum of limestone and sandstone on divides and small plateaus. Rock outcrop is in rimrock areas and on the steep upper sides of drainageways. Vanocker soils formed in material weathered from limestone and sandstone on the lower sides of canyons and mountains. The shallow Midway soils formed in material weathered from shale in convex areas on the lower part of a ridge that surrounds the Black Hills. The ridge is called a "hogback." The deep Mathias and Rockoa soils formed in material weathered from interbedded sandstone and shale on the sides of this ridge, and the shallow Butche soils formed in material weathered from sandstone on the upper convex parts of the ridge.

Kyle, Pierre, Samsil, and other soils formed in material weathered from clayey shale of the Pierre Formation. Manvel and Minnequa soils formed in material weathered from limestone of the Niobrara Formation. A small area of the White River Formation is exposed in the east-central part of the county. Epping, Kadoka, and Orella soils formed in this area.

Widely scattered silty and sandy eolian deposits are throughout the county. Dailey, Dwyer, Valent, and other soils formed in the sandy material. Colby and Norka soils formed in the silty loess.

Alluvium is deposited on the high terraces along the Cheyenne River and on the flood plains along the larger drainageways throughout the county. Altvan, Nunn, Satanta, and Savo soils formed on the high terraces. Bankard, Glenberg, and Haverson soils formed on the flood plains. Absted and Arvada soils formed in alluvium on the higher plains.

relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the more sloping soils, such as Colby soils, for example, much of the rainfall is lost through runoff and thus does not penetrate the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and are calcareous at or near the surface. Runoff is less rapid on Norka, Savo, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than the Colby soils. Also, the horizons in which organic matter accumulates are thicker.

Hoven soils are in depressions where water ponds. They have the colors characteristic of poorly drained soils.

time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. The degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable for the longest time. In Fall River County these are the Norka, Nunn, and Savo soils. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Colby soils are an example of young soils that are subject to natural erosion, and Lohmiller soils are an example of young alluvial soils.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compact layers to depths below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are—

	Inches
Deep	more than 40
Moderately deep	20 to 40
Shallow	10 to 20
Very shallow	less than 10

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water through cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10

square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 100 years is 75 feet, the site index is 75 feet.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a

drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey are—

	Percent
Nearly level	0 to 2
Gently sloping	2 to 6
Moderately sloping or gently rolling	6 to 9
Strongly sloping or rolling	9 to 15
Moderately steep or hilly	15 to 25
Steep	25 to 40
Very steep	more than 40

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily

rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-77 at Oelrichs, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	^oF	^oF	^oF	^oF	^oF	Units	In	In	In		In
January-----	35.5	10.7	23.1	61	-25	11	.39	.13	.59	1	5.1
February---	41.7	15.3	28.5	70	-20	36	.54	.19	.81	2	6.3
March------	48.2	20.7	34.5	78	-12	84	1.07	.64	1.44	3	10.3
April------	60.6	31.5	46.1	88	9	219	2.06	.92	2.99	5	6.8
May--------	71.7	42.0	56.9	92	24	524	2.96	1.34	4.27	6	.4
June-------	82.1	51.3	66.7	104	34	801	2.80	1.38	3.96	6	.1
July-------	91.4	57.4	74.4	108	41	1,066	2.17	.91	3.19	5	.0
August-----	90.6	55.6	73.0	106	38	1,023	1.44	.28	2.33	3	.0
September--	79.4	44.4	62.0	101	23	660	1.31	.42	2.01	3	.4
October----	66.5	33.7	50.1	90	14	320	.83	.30	1.25	2	2.3
November---	48.7	21.9	35.3	73	-7	62	.47	.17	.71	2	4.9
December---	38.3	14.1	26.2	66	-18	12	.42	.16	.63	1	5.4
Yearly:											
Average--	62.9	33.2	48.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	109	-26	---	---	---	---	---	---
Total----	---	---	---	---	---	4,818	16.46	13.39	19.58	39	42.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40^o F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-77 at Oelrichs, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 11	May 18	June 8
2 years in 10 later than--	May 5	May 12	May 31
5 years in 10 later than--	April 24	April 30	May 15
First freezing temperature in fall:			
1 year in 10 earlier than--	September 25	September 15	September 9
2 years in 10 earlier than--	September 30	September 20	September 14
5 years in 10 earlier than--	October 11	September 29	September 23

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-77 at Oelrichs, South Dakota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	142	129	98
8 years in 10	152	137	109
5 years in 10	170	152	130
2 years in 10	189	167	153
1 year in 10	201	177	167

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Aa	Absted silt loam	2,885	0.3
AaC	Alice fine sandy loam, 2 to 9 percent slopes	2,930	0.3
AbA	Altvan loam, 0 to 2 percent slopes	1,315	0.1
AbB	Altvan loam, 2 to 6 percent slopes	960	0.1
Ap	Aquolls, nearly level	965	0.1
Ar	Arvada loam	19,980	1.8
AsB	Ascalon fine sandy loam, 0 to 6 percent slopes	17,295	1.6
AsC	Ascalon fine sandy loam, 6 to 9 percent slopes	2,975	0.3
Ba	Badland	1,310	0.1
Bb	Bankard fine sandy loam	6,905	0.6
Bc	Barnum silt loam	3,100	0.3
BoA	Boneek silt loam, 0 to 2 percent slopes	600	0.1
BoB	Boneek silt loam, 2 to 6 percent slopes	2,970	0.3
BpB	Boneek silt loam, bedrock substratum, 2 to 6 percent slopes	2,130	0.2
BrD	Broadhurst clay, 2 to 15 percent slopes	2,555	0.2
BuB	Bufton silty clay loam, 2 to 6 percent slopes	1,160	0.1
BvD	Butche-Boneek complex, 3 to 15 percent slopes	28,480	2.6
CnD	Colby-Norka silt loams, 6 to 15 percent slopes	6,840	0.6
DaB	Dailey fine sand, 0 to 6 percent slopes	16,015	1.4
DaC	Dailey fine sand, 6 to 12 percent slopes	15,320	1.4
DwA	Dwyer loamy fine sand, 0 to 2 percent slopes	2,020	0.2
DwB	Dwyer loamy fine sand, 2 to 6 percent slopes	5,985	0.5
DwE	Dwyer loamy fine sand, 6 to 25 percent slopes	6,125	0.5
EaC	Eckley loam, 0 to 9 percent slopes	2,010	0.2
Ga	Glenberg fine sandy loam	9,240	0.8
GrE	Grummit-Rock outcrop complex, 3 to 40 percent slopes	15,185	1.4
GsD	Grummit-Snomo clays, 3 to 15 percent slopes	25,270	2.3
Ha	Haverson loam	11,165	1.0
HbB	Haverson Variant loam, 3 to 9 percent slopes	765	0.1
He	Hisle-Slickspots complex	46,375	4.2
Ho	Hoven silt loam	965	0.1
JaB	Jayem fine sandy loam, 2 to 9 percent slopes	6,760	0.6
KaB	Kadoka silt loam, 0 to 6 percent slopes	435	*
KeD	Kadoka-Epping silt loams, 6 to 15 percent slopes	1,740	0.2
KyA	Kyle clay, 0 to 2 percent slopes	24,155	2.2
KyB	Kyle clay, 2 to 6 percent slopes	27,240	2.4
Lo	Lohmiller silty clay loam	21,355	1.9
MaA	Manvel silt loam, 0 to 2 percent slopes	665	0.1
MbA	Manzanola silty clay loam, 0 to 2 percent slopes	4,590	0.4
MbB	Manzanola silty clay loam, 2 to 6 percent slopes	16,770	1.5
MmE	Mathias-Midway-Rock outcrop complex, 15 to 30 percent slopes	23,855	2.1
MnF	Mathias-Rockoa-Rock outcrop complex, 25 to 60 percent slopes	33,050	3.0
MoB	Minnequa silt loam, 2 to 6 percent slopes	31,030	2.8
MpE	Minnequa-Midway silty clay loams, 6 to 25 percent slopes	37,250	3.3
MtA	Mitchell very fine sandy loam, 0 to 2 percent slopes	240	*
MtB	Mitchell very fine sandy loam, 2 to 6 percent slopes	445	*
NeD	Nevee silt loam, 6 to 15 percent slopes	1,295	0.1
NoA	Norka silt loam, 0 to 2 percent slopes	1,185	0.1
NoB	Norka silt loam, 2 to 6 percent slopes	24,640	2.2
NoC	Norka silt loam, 6 to 9 percent slopes	5,455	0.5
NuA	Nunn clay loam, 0 to 2 percent slopes	7,020	0.6
NuB	Nunn clay loam, 2 to 6 percent slopes	8,875	0.8
NuC	Nunn clay loam, 6 to 9 percent slopes	1,615	0.1
OrE	Orella-Rock outcrop complex, 6 to 40 percent slopes	2,180	0.2
PaD	Paunsaugunt-Boneek complex, 6 to 15 percent slopes	4,260	0.4
PbF	Paunsaugunt-Vanocker-Rock outcrop complex, 9 to 60 percent slopes	13,855	1.2
PeB	Pierre clay, 2 to 6 percent slopes	120,124	10.7
PgE	Pierre-Grummit clays, 6 to 25 percent slopes	22,490	2.0
PsE	Pierre-Samsil clays, 6 to 25 percent slopes	201,025	18.0
Pt	Pits, gravel	390	*
Pu	Pits, mine	465	*
ReD	Rekop-Tilford-Gystrum complex, 6 to 15 percent slopes	6,695	0.6
RgF	Rock outcrop-Gystrum complex, 9 to 50 percent slopes	7,075	0.6
RoF	Rock outcrop-Mathias-Butche complex, 30 to 75 percent slopes	26,765	2.4
RrF	Rockoa-Rock outcrop complex, 25 to 60 percent slopes	4,575	0.4
SaE	Samsil clay, 15 to 40 percent slopes	30,210	2.7
SbD	Samsil-Pierre clays, 6 to 15 percent slopes	8,930	0.8
ScA	Satanta loam, 0 to 2 percent slopes	1,820	0.2
ScB	Satanta loam, 2 to 6 percent slopes	2,745	0.2
ScC	Satanta loam, 6 to 9 percent slopes	560	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
SdA	Savo silt loam, 0 to 2 percent slopes	5,560	0.5
SdB	Savo silt loam, 2 to 6 percent slopes	25,265	2.3
SmE	Schamber-Eckley complex, 9 to 40 percent slopes	6,595	0.6
SnE	Shingle-Penrose-Rock outcrop complex, 15 to 40 percent slopes	26,960	2.4
SpF	Spearfish-Rock outcrop complex, 9 to 50 percent slopes	2,895	0.3
SsE	Spearfish-Tilford extremely stony loams, 6 to 25 percent slopes	665	0.1
St	Stetter clay	8,880	0.8
Sw	Swanboy clay	2,885	0.3
TaA	Tilford silt loam, 0 to 2 percent slopes	1,480	0.1
TaB	Tilford silt loam, 2 to 6 percent slopes	2,775	0.2
TaC	Tilford silt loam, 6 to 9 percent slopes	465	*
TgC	Tilford-Gystrum complex, 2 to 9 percent slopes	3,495	0.3
VaE	Valent loamy fine sand, 6 to 25 percent slopes	12,330	1.1
WpC	Winler-Pierre clays, 2 to 9 percent slopes	8,035	0.7
ZnE	Zigweid-Nihill complex, 6 to 20 percent slopes	7,315	0.7
	Water (<40 acres in size)	4,360	0.4
	Total land area	1,115,584	100.0
	Open water (more than 40 acres in size)	5,060	
	Total area	1,120,644	

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Only arable soils are listed. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Oats		Winter wheat	Grain sorghum		Corn	Alfalfa hay		Cool-season grass
	N	I	N	N	I	I	N	I	N
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*
Aa---Absted	20	---	15	18	---	---	0.7	---	1.2
AaC---Alice	30	---	24	28	---	110	1.2	2.7	2.0
AbA---Altvan	28	---	24	26	---	115	1.0	2.5	1.7
AbB---Altvan	27	---	23	24	---	105	0.9	2.4	1.5
AsB---Ascalon	35	---	26	30	---	130	1.3	2.7	2.2
AsC---Ascalon	30	---	20	24	---	110	1.2	2.5	2.0
Bc---Barnum	---	---	---	---	---	---	2.0	---	3.3
BoA---Boneek	40	---	33	35	---	---	1.6	---	2.7
BoB---Boneek	37	---	31	33	---	---	1.5	---	2.5
BpB---Boneek	37	---	31	31	---	---	1.5	---	2.5
BuB---Bufton	33	---	25	28	---	---	1.4	---	2.3
DwA---Dwyer	---	---	---	---	---	---	---	---	2.0
Ga---Glenberg	30	---	20	30	---	120	1.4	2.8	2.3
Ha---Haverson	40	---	25	32	---	130	1.7	3.0	2.8
JaB---Jayem	29	---	24	30	---	120	1.2	2.6	2.0
KaB---Kadoka	38	---	27	32	---	---	1.1	---	1.8
KyA---Kyle	33	---	32	30	---	70	1.3	2.6	2.2
KyB---Kyle	32	---	30	28	---	---	1.2	---	2.0
Lo---Lohmiller	38	---	30	32	---	---	1.8	---	3.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats		Winter wheat	Grain sorghum		Corn	Alfalfa hay		Cool-season grass
	N	I	N	N	I	I	N	I	N
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*
MaA----------------------- Manvel	30	---	21	26	---	---	1.1	---	1.8
MbA----------------------- Manzanola	32	---	25	30	---	---	1.1	---	1.8
MbB----------------------- Manzanola	30	---	24	28	---	---	1.0	---	1.7
MoB----------------------- Minnequa	28	---	21	24	---	---	0.9	---	1.5
MtA----------------------- Mitchell	32	---	23	30	---	---	1.4	2.9	2.3
MtB----------------------- Mitchell	30	---	21	29	---	---	1.3	2.8	2.2
NoA----------------------- Norka	38	---	30	34	---	125	1.5	2.9	2.5
NoB----------------------- Norka	36	---	29	32	---	120	1.4	2.7	2.3
NoC----------------------- Norka	30	---	23	26	---	---	1.2	---	2.0
NuA----------------------- Nunn	40	---	33	35	---	125	1.6	3.0	2.7
NuB----------------------- Nunn	38	---	31	33	---	120	1.5	2.8	2.5
NuC----------------------- Nunn	32	---	26	27	---	---	1.3	2.2	2.2
PeB----------------------- Pierre	29	---	24	28	---	---	1.2	---	2.0
ScA----------------------- Satanta	40	---	32	36	---	135	1.6	3.3	2.7
ScB----------------------- Satanta	38	---	30	34	---	130	1.5	3.1	2.5
ScC----------------------- Satanta	32	---	22	26	---	---	1.3	---	2.2
SdA----------------------- Savo	38	---	30	32	---	125	1.5	3.0	2.5
SdB----------------------- Savo	36	---	28	30	---	115	1.4	2.8	2.3
St------------------------ Stetter	---	---	---	---	---	---	1.3	---	2.2
TaA----------------------- Tilford	42	---	32	37	---	---	1.7	---	2.8
TaB----------------------- Tilford	40	---	30	35	---	---	1.7	---	2.8
TaC----------------------- Tilford	---	---	---	29	---	---	1.5	---	2.5
TgC----------------------- Tilford-Gystrum	---	---	---	---	---	---	0.9	---	1.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Aa: Absted	Claypan	Favorable	1,400	Western wheatgrass	25
		Normal	1,200	Blue grama	25
		Unfavorable	800	Needleandthread	15
				Buffalograss	15
				Green needlegrass	5
AaC: Alice	Sandy	Favorable	2,000	Prairie sandreed	30
		Normal	1,700	Little bluestem	15
		Unfavorable	1,200	Needleandthread	10
				Threadleaf sedge	10
				Western wheatgrass	10
				Sand bluestem	10
				Blue grama	5
AbA, AbB: Altvan	Silty	Favorable	2,000	Western wheatgrass	50
		Normal	1,700	Green needlegrass	20
		Unfavorable	1,200	Blue grama	10
				Needleandthread	10
Ar: Arvada	Thin Claypan	Favorable	840	Blue grama	40
		Normal	700	Western wheatgrass	20
		Unfavorable	420	Buffalograss	15
				Gardner saltbush	5
				Inland saltgrass	5
				Sedge	5
AsB, AsC: Ascalon	Sandy	Favorable	2,300	Prairie sandreed	30
		Normal	1,900	Needleandthread	20
		Unfavorable	1,300	Little bluestem	20
				Blue grama	10
				Western wheatgrass	10
				Sideoats grama	5
Bb: Bankard	Sands	Favorable	2,600	Sand bluestem	25
		Normal	2,200	Prairie sandreed	20
		Unfavorable	1,500	Switchgrass	10
				Sand dropseed	10
				Sand sagebrush	10
				Blue grama	10
				Needleandthread	5
Bc: Barnum	Loamy Terrace	Favorable	3,100	Big bluestem	45
		Normal	2,600	Western wheatgrass	15
		Unfavorable	1,800	Little bluestem	15
				Blue grama	10
BoA, BoB, BpB: Boneek	Silty	Favorable	2,400	Western wheatgrass	50
		Normal	2,000	Green needlegrass	15
		Unfavorable	1,400	Needleandthread	15
				Blue grama	15
BrD: Broadhurst	Dense Clay	Favorable	1,700	Western wheatgrass	50
		Normal	1,300	Green needlegrass	20
		Unfavorable	800	Montana wheatgrass	10
BuB: Bufton	Clayey	Favorable	2,000	Western wheatgrass	50
		Normal	1,700	Blue grama	15
		Unfavorable	1,100	Green needlegrass	15
				Little bluestem	5
				Sideoats grama	5
				Buffalograss	5
BvD*:					
Butche	Shallow	Favorable	1,800	Little bluestem	30
		Normal	1,500	Prairie sandreed	15
		Unfavorable	1,000	Western wheatgrass	10
				Sideoats grama	10
				Needleandthread	10
				Big bluestem	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
BvD*:					
Boneek	Silty	Favorable	2,400	Western wheatgrass	50
		Normal	2,000	Green needlegrass	15
		Unfavorable	1,400	Needleandthread	15
				Blue grama	15
CnD*:					
Colby	Thin Upland	Favorable	1,800	Blue grama	25
		Normal	1,500	Needleandthread	25
		Unfavorable	800	Little bluestem	10
				Western wheatgrass	10
				Sideoats grama	10
				Buffalograss	5
				Sedge	5
Norka	Silty	Favorable	2,300	Western wheatgrass	45
		Normal	1,900	Blue grama	15
		Unfavorable	1,300	Green needlegrass	15
				Needleandthread	10
				Buffalograss	5
				Sedge	5
DaB, DaC: Dailey	Sands	Favorable	2,400	Prairie sandreed	25
		Normal	2,000	Little bluestem	25
		Unfavorable	1,400	Blue grama	10
				Sand bluestem	10
				Needlegrass	10
				Sand dropseed	5
				Sand sagebrush	5
DwA, DwB, DwE: Dwyer	Sandy	Favorable	2,000	Needleandthread	20
		Normal	1,700	Prairie sandreed	20
		Unfavorable	1,100	Blue grama	10
				Western wheatgrass	10
				Sand bluestem	10
				Little bluestem	5
				Sand dropseed	5
				Sand sagebrush	5
				Threadleaf sedge	5
EaC: Eckley	Shallow to Gravel	Favorable	1,400	Blue grama	25
		Normal	1,200	Western wheatgrass	20
		Unfavorable	800	Needleandthread	10
				Sedge	10
				Green needlegrass	10
				Sideoats grama	5
				Little bluestem	5
Ga: Glenberg	Loamy Terrace	Favorable	3,000	Little bluestem	20
		Normal	2,500	Sand bluestem	20
		Unfavorable	1,750	Prairie sandreed	20
				Needlegrass	10
				Western wheatgrass	10
				Blue grama	5
				Sedge	5
GrE*:					
Grummit	Shallow Clay	Favorable	1,400	Little bluestem	30
		Normal	1,200	Western wheatgrass	20
		Unfavorable	800	Blue grama	15
				Sideoats grama	10
				Sedge	10
Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
GsD*:					
Grummit	Shallow Clay	Favorable	1,700	Little bluestem	30
		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Sedge	10
Snomo	Clay Savannah	Favorable	1,700	Little bluestem	20
		Normal	1,400	Western wheatgrass	20
		Unfavorable	800	Sedge	20
				Bur oak	15
				Big bluestem	10
				Ponderosa pine	10
				Blue grama	5
Ha Haverson	Loamy Terrace	Favorable	2,800	Western wheatgrass	55
		Normal	2,300	Green needlegrass	15
		Unfavorable	1,600	Blue grama	15
				Big bluestem	5
				Sedge	5
HbB Haverson Variant	Loamy Terrace	Favorable	2,800	Western wheatgrass	40
		Normal	2,300	Green needlegrass	20
		Unfavorable	1,600	Needleandthread	10
				Prairie sandreed	5
				Big bluestem	5
				Blue grama	5
				Buffalograss	5
				Sedge	5
He*:					
Hisle	Thin Claypan	Favorable	1,100	Blue grama	45
		Normal	900	Buffalograss	25
		Unfavorable	500	Western wheatgrass	10
				Sedge	10
Slickspots.					
Ho Hoven	Closed Depression	Favorable	2,600	Western wheatgrass	70
		Normal	2,400	Sedge	15
		Unfavorable	1,700	Blue grama	5
				Buffalograss	5
JaB Jayem	Sandy	Favorable	2,300	Prairie sandreed	30
		Normal	1,900	Little bluestem	20
		Unfavorable	1,300	Sand bluestem	15
				Needleandthread	10
				Sedge	10
				Western wheatgrass	10
				Blue grama	5
KaB Kadoka	Silty	Favorable	2,400	Western wheatgrass	45
		Normal	2,000	Green needlegrass	15
		Unfavorable	1,400	Needleandthread	15
				Blue grama	15
				Sideoats grama	5
KeD*:					
Kadoka	Silty	Favorable	2,400	Western wheatgrass	45
		Normal	2,000	Green needlegrass	15
		Unfavorable	1,400	Needleandthread	15
				Blue grama	15
				Sideoats grama	5
Epping	Shallow	Favorable	1,800	Needleandthread	20
		Normal	1,500	Western wheatgrass	20
		Unfavorable	1,000	Blue grama	15
				Threadleaf sedge	10
				Sideoats grama	10
				Little bluestem	10
				Buffalograss	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
KyA, KyB: Kyle	Clayey	Favorable	2,000	Western wheatgrass	50
		Normal	1,700	Green needlegrass	25
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5
Lo: Lohmiller	Loamy Terrace	Favorable	2,800	Western wheatgrass	50
		Normal	2,300	Green needlegrass	30
		Unfavorable	1,600	Blue grama	10
				Buffalograss	5
MaA: Manvel	Thin Upland	Favorable	1,800	Blue grama	25
		Normal	1,500	Needlegrass	25
		Unfavorable	1,000	Sedge	20
				Western wheatgrass	15
MbA, MbB: Manzanola	Clayey	Favorable	2,000	Western wheatgrass	50
		Normal	1,700	Needlegrass	20
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5
				Sedge	5
MmE*:					
Mathias	Stony Hills	Favorable	2,500	Big bluestem	35
		Normal	2,100	Little bluestem	20
		Unfavorable	1,600	Needlegrass	15
				Sideoats grama	10
				Western wheatgrass	10
				Blue grama	5
Midway	Shallow	Favorable	1,600	Western wheatgrass	30
		Normal	1,400	Green needlegrass	15
		Unfavorable	900	Sideoats grama	15
				Blue grama	10
				Buffalograss	5
				Little bluestem	5
				Prairie junegrass	5
Rock outcrop.					
MnF*:					
Mathias	Stony Hills	Favorable	2,500	Big bluestem	35
		Normal	2,100	Little bluestem	20
		Unfavorable	1,600	Needlegrass	15
				Sideoats grama	10
				Western wheatgrass	10
				Blue grama	5
Rockoa.					
Rock outcrop.					
MoB: Minnequa	Thin Upland	Favorable	1,800	Blue grama	25
		Normal	1,500	Needlegrass	25
		Unfavorable	1,000	Sedge	20
				Western wheatgrass	15
MpE*:					
Minnequa	Thin Upland	Favorable	1,800	Blue grama	25
		Normal	1,500	Needlegrass	25
		Unfavorable	1,000	Little bluestem	10
				Western wheatgrass	10
				Sedge	10
Midway	Shallow	Favorable	1,600	Western wheatgrass	30
		Normal	1,400	Green needlegrass	15
		Unfavorable	900	Sideoats grama	15
				Blue grama	10
				Buffalograss	5
				Little bluestem	5
				Prairie junegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
MtA, MtB: Mitchell	Thin Upland	Favorable	1,800	Blue grama	25
		Normal	1,500	Needleandthread	25
		Unfavorable	1,000	Threadleaf sedge	15
				Green needlegrass	10
				Western wheatgrass	10
NeD: Nevee	Thin Upland	Favorable	2,000	Needlegrass	25
		Normal	1,700	Blue grama	20
		Unfavorable	1,200	Little bluestem	10
				Western wheatgrass	10
				Sideoats grama	10
				Sedge	10
NoA, NoB, NoC: Norka	Silty	Favorable	2,300	Western wheatgrass	45
		Normal	1,900	Blue grama	15
		Unfavorable	1,300	Green needlegrass	15
				Needleandthread	10
				Buffalograss	5
				Sedge	5
NuA, NuB, NuC: Nunn	Clayey	Favorable	2,200	Western wheatgrass	50
		Normal	1,800	Green needlegrass	25
		Unfavorable	1,300	Blue grama	10
				Buffalograss	5
OrE*:					
Orella	Shallow Clay	Favorable	1,200	Western wheatgrass	40
		Normal	1,000	Blue grama	15
		Unfavorable	700	Green needlegrass	10
				Buffalograss	5
				Common pricklypear	5
Rock outcrop.					
PaD*:					
Paunsaugunt	Shallow	Favorable	1,400	Little bluestem	35
		Normal	1,200	Needlegrass	20
		Unfavorable	800	Sideoats grama	10
				Shrubs	10
Boneek	Silty	Favorable	2,200	Western wheatgrass	50
		Normal	1,800	Green needlegrass	15
		Unfavorable	1,300	Needleandthread	15
				Blue grama	15
PbF*:					
Paunsaugunt	Shallow	Favorable	1,400	Little bluestem	35
		Normal	1,200	Needlegrass	20
		Unfavorable	800	Sideoats grama	10
				Shrubs	10
Vanocker.					
Rock outcrop.					
PeB: Pierre	Clayey	Favorable	2,000	Western wheatgrass	60
		Normal	1,700	Green needlegrass	15
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5
PgE*:					
Pierre	Clayey	Favorable	2,000	Western wheatgrass	60
		Normal	1,700	Green needlegrass	15
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo-sition
		Kind of year	Dry weight		
			Lb/acre		Pct
PgE*:					
Grummit	Shallow Clay	Favorable	1,400	Little bluestem	30
		Normal	1,200	Western wheatgrass	20
		Unfavorable	800	Blue grama	15
				Sideoats grama	10
				Sedge	10
PsE*:					
Pierre	Clayey	Favorable	2,000	Western wheatgrass	60
		Normal	1,700	Green needlegrass	15
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5
Samsil	Shallow Clay	Favorable	1,400	Western wheatgrass	30
		Normal	1,200	Little bluestem	25
		Unfavorable	900	Sideoats grama	15
				Green needlegrass	10
				Blue grama	10
				Sedge	5
ReD*:					
Rekop	Shallow	Favorable	1,700	Little bluestem	40
		Normal	1,400	Sideoats grama	15
		Unfavorable	1,000	Blue grama	10
				Needleandthread	10
				Threadleaf sedge	5
				Western wheatgrass	5
Tilford	Silty	Favorable	2,600	Little bluestem	25
		Normal	2,200	Western wheatgrass	20
		Unfavorable	1,500	Big bluestem	15
				Green needlegrass	15
				Needleandthread	5
				Blue grama	5
				Kentucky bluegrass	5
				Leadplant	5
Gystrum	Thin Upland	Favorable	1,400	Little bluestem	30
		Normal	1,100	Western wheatgrass	15
		Unfavorable	1,000	Needlegrass	15
				Threadleaf sedge	10
				Sideoats grama	5
RgF*:					
Rock outcrop.					
Gystrum	Thin Upland	Favorable	1,400	Little bluestem	30
		Normal	1,100	Western wheatgrass	15
		Unfavorable	1,000	Needlegrass	15
				Threadleaf sedge	10
				Sideoats grama	5
RoF*:					
Rock outcrop.					
Mathias	Stony Hills	Favorable	2,500	Big bluestem	35
		Normal	2,100	Little bluestem	20
		Unfavorable	1,600	Needlegrass	15
				Sideoats grama	10
				Western wheatgrass	10
				Blue grama	5
Butche	Shallow	Favorable	1,800	Little bluestem	30
		Normal	1,500	Prairie sandreed	15
		Unfavorable	1,000	Western wheatgrass	10
				Sideoats grama	10
				Needleandthread	10
				Big bluestem	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
SaE: Samsil	Shallow Clay	Favorable	1,400	Western wheatgrass	30
		Normal	1,200	Little bluestem	25
		Unfavorable	900	Sideoats grama	15
				Green needlegrass	10
				Blue grama	10
				Sedge	5
SbD*:					
Samsil	Shallow Clay	Favorable	1,400	Western wheatgrass	30
		Normal	1,200	Little bluestem	25
		Unfavorable	900	Sideoats grama	15
				Green needlegrass	10
				Blue grama	10
				Sedge	5
Pierre	Clayey	Favorable	2,000	Western wheatgrass	60
		Normal	1,700	Green needlegrass	15
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5
ScA, ScB, ScC: Satanta	Silty	Favorable	2,300	Western wheatgrass	40
		Normal	1,900	Blue grama	20
		Unfavorable	1,300	Needleandthread	20
				Green needlegrass	10
				Prairie sandreed	5
SdA, SdB: Savo	Silty	Favorable	2,300	Western wheatgrass	45
		Normal	1,900	Green needlegrass	15
		Unfavorable	1,300	Needleandthread	15
				Blue grama	15
				Prairie sandreed	5
				Sideoats grama	5
SmE*:					
Schamber	Very Shallow	Favorable	1,100	Sedge	30
		Normal	900	Blue grama	25
		Unfavorable	600	Needleandthread	20
				Buffalograss	5
Eckley	Shallow to Gravel	Favorable	1,400	Blue grama	25
		Normal	1,200	Western wheatgrass	20
		Unfavorable	800	Needleandthread	10
				Sedge	10
				Green needlegrass	10
				Sideoats grama	5
				Little bluestem	5
SnE*:					
Shingle	Shallow	Favorable	1,800	Needleandthread	20
		Normal	1,500	Western wheatgrass	20
		Unfavorable	1,000	Little bluestem	20
				Blue grama	10
				Sideoats grama	10
				Threadleaf sedge	10
				Galleta	10
Penrose	Shallow	Favorable	1,500	Blue grama	20
		Normal	1,400	Little bluestem	20
		Unfavorable	1,200	Needlegrass	20
				Western wheatgrass	15
				Sideoats grama	10
				Threadleaf sedge	10
Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
SpF*:					
Spearfish	Shallow	Favorable	1,800	Little bluestem	30
		Normal	1,500	Prairie sandreed	15
		Unfavorable	1,000	Western wheatgrass	10
				Needleandthread	10
				Big bluestem	5
				Prairie dropseed	5
				Sideoats grama	5
Rock outcrop.					
SsE*:					
Spearfish	Shallow	Favorable	1,800	Little bluestem	30
		Normal	1,500	Prairie sandreed	15
		Unfavorable	1,000	Prairie dropseed	10
				Big bluestem	5
				Western wheatgrass	5
				Needleandthread	5
				Sideoats grama	5
Tilford	Silty	Favorable	2,500	Little bluestem	25
		Normal	2,100	Western wheatgrass	20
		Unfavorable	1,600	Big bluestem	15
				Green needlegrass	15
				Needleandthread	5
				Blue grama	5
				Kentucky bluegrass	5
				Leadplant	5
St: Stetter	Clayey Overflow	Favorable	2,600	Western wheatgrass	60
		Normal	2,200	Green needlegrass	10
		Unfavorable	1,500	Switchgrass	10
				Sedge	5
Sw: Swanboy	Dense Clay	Favorable	1,500	Western wheatgrass	60
		Normal	1,200	Green needlegrass	25
		Unfavorable	700		
TaA, TaB, TaC: Tilford	Silty	Favorable	2,600	Little bluestem	25
		Normal	2,200	Western wheatgrass	20
		Unfavorable	1,500	Big bluestem	15
				Green needlegrass	15
				Needleandthread	5
				Blue grama	5
				Kentucky bluegrass	5
				Leadplant	5
TgC*:					
Tilford	Silty	Favorable	2,600	Little bluestem	25
		Normal	2,200	Western wheatgrass	20
		Unfavorable	1,500	Big bluestem	15
				Green needlegrass	15
				Needleandthread	5
				Blue grama	5
				Kentucky bluegrass	5
				Leadplant	5
Gystrum	Thin Upland	Favorable	1,800	Little bluestem	30
		Normal	1,500	Western wheatgrass	15
		Unfavorable	1,000	Needlegrass	15
				Threadleaf sedge	10
				Sideoats grama	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VaE: Valent	Sands	Favorable	2,500	Prairie sandreed	20
		Normal	2,000	Sand bluestem	15
		Unfavorable	1,200	Blue grama	10
				Needlegrass	10
				Little bluestem	10
				Sand dropseed	5
				Sideoats grama	5
				Sand sagebrush	5
WpC*:					
Winler	Dense Clay	Favorable	1,700	Western wheatgrass	60
		Normal	1,300	Green needlegrass	20
		Unfavorable	800		
Pierre	Clayey	Favorable	2,000	Western wheatgrass	60
		Normal	1,700	Green needlegrass	15
		Unfavorable	1,200	Blue grama	15
				Buffalograss	5
ZnE*:					
Zigweid	Thin Upland	Favorable	1,800	Needleandthread	40
		Normal	1,500	Blue grama	20
		Unfavorable	900	Threadleaf sedge	20
				Western wheatgrass	10
Nihill	Thin Upland	Favorable	1,440	Needleandthread	30
		Normal	1,200	Western wheatgrass	15
		Unfavorable	840	Little bluestem	15
				Blue grama	15
				Threadleaf sedge	15
				Sideoats grama	5
				Green needlegrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
MmE*:								
Mathias	6r	Severe	Moderate	Severe	Slight	Ponderosa pine	40	Ponderosa pine.
Midway.								
Rock outcrop.								
MnF*:								
Mathias	6r	Severe	Severe	Severe	Slight	Ponderosa pine	40	Ponderosa pine.
Rockoa	5r	Severe	Severe	Moderate	Slight	Ponderosa pine	50	Ponderosa pine.
Rock outcrop.								
PbF*:								
Paunsaugunt	6d	Moderate	Slight	Severe	Moderate	Ponderosa pine	40	Ponderosa pine.
Vanocker	5f	Severe	Severe	Moderate	Slight	Ponderosa pine	50	Ponderosa pine.
Rock outcrop.								
RoF*:								
Rock outcrop.								
Mathias	6r	Severe	Severe	Severe	Slight	Ponderosa pine	40	Ponderosa pine.
Butche.								
RrF*:								
Rockoa	5r	Severe	Severe	Moderate	Slight	Ponderosa pine	50	Ponderosa pine.
Rock outcrop.								

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
Aa----------------- Absted	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle, lilac.	Siberian elm, ponderosa pine, green ash, Russian-olive.	---	---
AaC---------------- Alice	American plum, Siberian peashrub, skunkbush sumac, lilac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, common hackberry.	Siberian elm.
AbA, AbB----------- Altvan	Siberian peashrub, skunkbush sumac, Tatarian honeysuckle, Peking cotoneaster.	Common hackberry, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, honeylocust.	Siberian elm, ponderosa pine.	---
Ap*. Aquolls				
Ar. Arvada				
AsB, AsC----------- Ascalon	American plum, Siberian peashrub, skunkbush sumac, lilac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, common hackberry.	Siberian elm.
Ba*. Badland				
Bb----------------- Bankard	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---
Bc----------------- Barnum	---	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
BoA, BoB, BpB------ Boneek	Lilac------------------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
BrD---------------- Broadhurst	---	---	---	---
BuB---------------- Bufton	Siberian peashrub, Tatarian honeysuckle, American plum, lilac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, green ash, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35
BvD*: Butche.				
Boneek	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
CnD*: Colby	Siberian peashrub	Ponderosa pine, eastern redcedar, Russian-olive, Rocky Mountain juniper.	Siberian elm	---
Norka	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Russian-olive.	---
DaB, DaC: Dailey	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---
DwA, DwB, DwE: Dwyer	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---
EaC: Eckley	Siberian peashrub, lilac.	Siberian elm, ponderosa pine, common hackberry, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	---	---
Ga: Glenberg	Lilac	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
GrE*: Grummit.				
Rock outcrop.				
GsD*: Grummit.				
Snomo.				
Ha: Haverson	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
HbB. Haverson Variant				
He*: Hisle.				
Slickspots.				

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35
Ho. Hoven				
JaB Jayem	American plum, silver buffaloberry, lilac.	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Siberian elm, ponderosa pine, bur oak, Russian-olive.	---
KaB Kadoka	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
KeD*: Kadoka.	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
Epping.				
KyA, KyB Kyle	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Lo Lohmiller	Lilac	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
MaA Manvel	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, lilac, silver buffaloberry.	Ponderosa pine, Siberian elm, green ash, Russian-olive.	---	---
MbA, MbB Manzanola	Siberian peashrub, silver buffaloberry, American plum, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
MmE*: Mathias.				
Midway.				
Rock outcrop.				
MnF*: Mathias.				
Rockoa.				
Rock outcrop.				
MoB Minnequa	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, lilac, silver buffaloberry.	Ponderosa pine, Siberian elm, green ash, Russian-olive.	---	---
MpE*: Minnequa.				
Midway.				

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35
MtA, MtB: Mitchell	Skunkbush sumac, Siberian peashrub, Tatarian honeysuckle, silver buffaloberry.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, honeylocust, green ash.	Siberian elm	---
NeD. Nevee				
NoA, NoB, NoC: Norka	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Russian-olive.	---
NuA, NuB, NuC: Nunn	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
OrE*: Orella.				
Rock outcrop.				
PaD*: Paunsaugunt.				
Boneek	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
PbF*: Paunsaugunt.				
Vanocker.				
Rock outcrop.				
PeB: Pierre	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
PgE*: Pierre.				
Grummit.				
PsE*: Pierre.				
Samsil.				
Pt*, Pu*. Pits				
ReD*: Rekop				

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
ReD*:				
Tilford	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, Ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
Gystrum.				
RgF*:				
Rock outcrop.				
Gystrum.				
RoF*:				
Rock outcrop.				
Mathias.				
Butche.				
RrF*:				
Rockoa.				
Rock outcrop.				
SaE.				
Samsil				
SbD*:				
Samsil.				
Pierre.				
ScA, ScB, ScC Satanta	Skunkbush sumac, lilac, Tatarian honeysuckle.	Russian-olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, common hackberry, bur oak.	Siberian elm.
SdA, SdB Savo	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
SmE*:				
Schamber.				
Eckley.				
SnE*:				
Shingle.				
Penrose.				
Rock outcrop.				
SpF*:				
Spearfish.				
Rock outcrop.				
SsE*:				
Spearfish.				

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35
SsE*: Tilford.				
St------------------- Stetter	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Sw. Swanboy				
TaA, TaB, TaC----- Tilford	Lilac------------------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
TgC*: Tilford-----------	Lilac------------------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
Gystrum.				
VaE---------------- Valent	---	Eastern redcedar, Rocky Mountain juniper, ponderosa pine.	---	---
WpC*: Winler.				
Pierre------------	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
ZnE*: Zigweid.				
Nihill.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aa------ Absted	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AaC------ Alice	Slight------	Slight------	Moderate: slope.	Slight.
AbA------ Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AbB------ Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ap*. Aquolls				
Ar------ Arvada	Moderate: percs slowly, dusty.	Moderate: percs slowly, dusty.	Moderate: percs slowly.	Moderate: dusty.
AsB------ Ascalon	Slight------	Slight------	Moderate: slope.	Slight.
AsC------ Ascalon	Slight------	Slight------	Severe: slope.	Slight.
Ba*. Badland				
Bb------ Bankard	Severe: flooding.	Slight------	Moderate: flooding.	Slight.
Bc------ Barnum	Severe: flooding.	Moderate: excess salt, dusty.	Moderate: flooding.	Severe: erodes easily.
BoA------ Boneek	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BoB, BpB------ Boneek	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
BrD------ Broadhurst	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
BuB------ Bufton	Slight------	Slight------	Moderate: slope.	Slight.
BvD*:				
Butche------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Boneek------	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
CnD*:				
Colby------	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
CnD*:				
Norka	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
DaB Dailey	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
DaC Dailey	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
DwA Dwyer	Slight	Slight	Slight	Slight.
DwB Dwyer	Slight	Slight	Moderate: slope.	Slight.
DwE Dwyer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
EaC Eckley	Slight	Slight	Severe: slope.	Moderate: dusty.
Ga Glenberg	Severe: flooding.	Slight	Slight	Slight.
GrE*:				
Grummit	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop.				
GsD*:				
Grummit	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: too clayey.
Snomo	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Ha Haverson	Severe: flooding.	Moderate: dusty.	Moderate: flooding.	Moderate: dusty.
HbB Haverson Variant	Severe: flooding.	Slight	Moderate: slope.	Slight.
He*:				
Hisle	Moderate: percs slowly, dusty.	Moderate: percs slowly, dusty.	Moderate: percs slowly.	Moderate: dusty.
Slickspots.				
Ho Hoven	Severe: ponding, percs slowly.	Severe: ponding, excess sodium, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
JaB Jayem	Slight	Slight	Moderate: slope.	Slight.
KaB Kadoka	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
KeD*:				
Kadoka	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Epping	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
KyA Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
KyB Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Severe: erodes easily.
Lo Lohmiller	Severe: flooding.	Slight	Slight	Slight.
MaA Manvel	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.
MbA Manzanola	Slight	Slight	Slight	Severe: erodes easily.
MbB Manzanola	Slight	Slight	Moderate: slope.	Severe: erodes easily.
MmE*:				
Mathias	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope.
Midway	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope.
Rock outcrop.				
MnF*:				
Mathias	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope.
Rockoa	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope.
Rock outcrop.				
MoB Minnequa	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.
MpE*:				
Minnequa	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Midway	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
MtA: Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
MtB: Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
NeD: Nevee	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
NoA: Norka	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
NoB: Norka	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
NoC: Norka	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
NuA: Nunn	Slight	Slight	Slight	Slight.
NuB: Nunn	Slight	Slight	Moderate: slope.	Slight.
NuC: Nunn	Slight	Slight	Severe: slope.	Slight.
OrE*:				
Orella	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop.				
PaD*:				
Paunsaugunt	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight.
Boneek	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
PbF*:				
Paunsaugunt	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight.
Vanocker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
PeB: Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
PgE*:				
Pierre	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Grummit	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope, too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PsE*:				
Pierre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Samsil	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Pt*, Pu*. Pits				
ReD*:				
Rekop	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Tilford	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Gystrum	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
RgF*: Rock outcrop.				
Gystrum	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
RoF*: Rock outcrop.				
Mathias	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope.
Butche	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
RrF*:				
Rockoa	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: slope.
Rock outcrop.				
SaE Samsil	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
SbD*:				
Samsil	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Pierre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
ScA Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
ScB Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
ScC Satanta	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SdA: Savo	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
SdB: Savo	Slight	Slight	Moderate: slope.	Slight.
SmE*:				
Schamber	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.
Eckley	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: dusty.
SnE*:				
Shingle	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Penrose	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope.
Rock outcrop.				
SpF*:				
Spearfish	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop.				
SsE*:				
Spearfish	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Moderate: dusty.
Tilford	Severe: large stones.	Severe: large stones.	Severe: large stones, slope.	Moderate: large stones, dusty.
St: Stetter	Severe: flooding.	Moderate: too clayey, percs slowly.	Moderate: too clayey, flooding.	Moderate: too clayey, flooding.
Sw: Swanboy	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
TaA: Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
TaB: Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
TaC: Tilford	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
TgC*:				
Tilford	Moderate: dusty.	Moderate: dusty.	Moderate slope, dusty.	Moderate: dusty.
Gystrum	Slight	Slight	Moderate: slope, depth to rock.	Severe: erodes easily.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VaE-------------------- Valent	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
WpC*:				
Winler----------------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, slope, percs slowly.	Moderate: too clayey.
Pierre----------------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
ZnE*:				
Zigweid---------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Nihill----------------	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: dusty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Potential as habitat for--: Openland wildlife	Woodland wildlife	Rangeland wildlife
Aa: Absted	Poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
AaC: Alice	Poor	Good	Good	Fair	Very poor	Fair	Very poor	Good.
AbA, AbB: Altvan	Poor	Poor	Good	Poor	Very poor	Poor	Very poor	Good.
Ap*. Aquolls								
Ar: Arvada	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
AsB, AsC: Ascalon	Poor	Good	Good	Fair	Very poor	Fair	Very poor	Good.
Ba*. Badland								
Bb: Bankard	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Bc: Barnum	Very poor	Good	Fair	Good	Poor	Poor	Very poor	Fair.
BoA, BoB, BpB: Boneek	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
BrD: Broadhurst	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
BuB: Bufton	Poor	Fair	Good	Fair	Very poor	Poor	Very poor	Good.
BvD*:								
Butche	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Boneek	Poor	Good	Good	Fair	Very poor	Poor	Very poor	Good.
CnD*:								
Colby	Very poor	Fair	Fair	Fair	Very poor	Poor	Very poor	Fair.
Norka	Poor	Good	Good	Good	Very poor	Fair	Very poor	Good.
DaB, DaC: Dailey	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
DwA: Dwyer	Poor	Very poor	Fair	Poor	Poor	Very poor	Very poor	Fair.
DwB, DwE: Dwyer	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair
EaC: Eckley	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
Ga: Glenberg	Poor	Fair	Good	Good	Very poor	Poor	Very poor	Good.
GrE*:								
Grummit	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.								

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements					Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Openland wildlife	Woodland wildlife	Rangeland wildlife
GsD*:								
Grummit	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Snomo	Very poor	Very poor	Good	Poor	Poor	Very poor	Poor	Good.
Ha: Haverson	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
HbB: Haverson Variant	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Good.
He*:								
Hisle	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
Slickspots.								
Ho: Hoven	Very poor	Poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
JaB: Jayem	Poor	Fair	Good	Fair	Very poor	Poor	Very poor	Good.
KaB: Kadoka	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
KeD*:								
Kadoka	Poor	Good	Good	Fair	Very poor	Fair	Very poor	Good.
Epping	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
KyA, KyB: Kyle	Poor	Fair	Good	Fair	Very poor	Poor	Very poor	Good.
Lo: Lohmiller	Fair	Good	Good	Good	Very poor	Good	Poor	Good.
MaA: Manvel	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
MbA, MbB: Manzanola	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
MmE*:								
Mathias	Very poor	Very poor	Fair	Poor	Poor	Very poor	Very poor	Fair.
Midway	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.								
MnF*:								
Mathias	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Rockoa	Very poor	Very poor	Very poor	Poor	Good	Very poor	Good	Very poor.
Rock outcrop.								
MoB: Minnequa	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
MpE*:								
Minnequa	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Midway	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Potential as habitat for--: Openland wildlife	Woodland wildlife	Rangeland wildlife
MtA, MtB----------- Mitchell	Fair	Fair	Fair	Fair	Very poor	Fair	Very poor	Fair.
NeD---------------- Nevee	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
NoA, NoB----------- Norka	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
NoC---------------- Norka	Poor	Good	Good	Fair	Very poor	Fair	Very poor	Good.
NuA, NuB----------- Nunn	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
NuC---------------- Nunn	Poor	Good	Good	Fair	Very poor	Fair	Very poor	Good.
OrE*:								
Orella------------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.								
PaD*:								
Paunsaugunt-------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Fair.
Boneek------------	Poor	Good	Good	Fair	Very poor	Poor	Very poor	Good.
PbF*:								
Paunsaugunt-------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Fair.
Vanocker----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Good	Very poor.
Rock outcrop.								
PeB---------------- Pierre	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Good.
PgE*:								
Pierre------------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Good.
Grummit-----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
PsE*:								
Pierre------------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Good.
Samsil------------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Pt*, Pu*. Pits								
ReD*:								
Rekop-------------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Tilford-----------	Fair	Good	Good	Fair	Very poor	Good	Very poor	Good.
Gystrum-----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
RgF*:								
Rock outcrop.								
Gystrum-----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
RoF*:								
Rock outcrop.								
Mathias-----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Butche------------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Potential as habitat for--: Openland wildlife	Woodland wildlife	Rangeland wildlife
RrF*:								
Rockoa	Very poor	Very poor	Very poor	Poor	Good	Very poor	Good	Very poor.
Rock outcrop.								
SaE Samsil	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
SbD*:								
Samsil	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Pierre	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Good.
ScA, ScB Satanta	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
ScC Satanta	Poor	Good	Good	Fair	Very poor	Fair	Very poor	Good.
SdA, SdB Savo	Fair	Good	Good	Good	Very poor	Good	Very poor	Good.
SmE*:								
Schamber	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
Eckley	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Fair.
SnE*:								
Shingle	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Penrose	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.								
SpF*:								
Spearfish	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.								
SsE*:								
Spearfish	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Tilford	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Good.
St Stetter	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair.
Sw Swanboy	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
TaA, TaB Tilford	Good	Good	Good	Good	Very poor	Good	Very poor	Good.
TaC Tilford	Fair	Good	Good	Fair	Very poor	Good	Very poor	Good.
TgC*:								
Tilford	Fair	Good	Good	Fair	Very poor	Good	Very poor	Good.
Gystrum	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
VaE Valent	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
WpC*:								
Winler	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements					Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Openland wildlife	Woodland wildlife	Rangeland wildlife
WpC*:								
Pierre------------	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Good.
ZnE*:								
Zigweid-----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.
Nihill------------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aa------------- Absted	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
AaC------------- Alice	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.
AbA------------- Altvan	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight-----------	Moderate: frost action.
AbB------------- Altvan	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.
Ap*. Aquolls					
Ar------------- Arvada	Slight-----------	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
AsB------------- Ascalon	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight-----------	Moderate: frost action.
AsC------------- Ascalon	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.
Ba*. Badland					
Bb------------- Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Bc------------- Barnum	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
BoA------------- Boneek	Slight-----------	Moderate: shrink-swell.	Slight-----------	Moderate: shrink-swell.	Severe: low strength.
BoB, BpB---------- Boneek	Slight-----------	Moderate: shrink-swell.	Slight-----------	Moderate: shrink-swell, slope.	Severe: low strength.
BrD------------- Broadhurst	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
BuB------------- Bufton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
BvD*:					
Butche-----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Boneek-----------	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CnD*:					
Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Norka	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
DaB: Dailey	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
DaC: Dailey	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
DwA: Dwyer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
DwB: Dwyer	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
DwE: Dwyer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
EaC: Eckley	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Ga: Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
GrE*:					
Grummit	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.
Rock outcrop.					
GsD*:					
Grummit	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
Snomo	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Ha: Haverson	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
HbB: Haverson Variant	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
He*:					
Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Slickspots.					
Ho: Hoven	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: ponding, low strength.
JaB: Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
KaB: Kadoka	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.
KeD*:					
Kadoka	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Severe: low strength.
Epping	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.
KyA, KyB: Kyle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Lo: Lohmiller	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
MaA: Manvel	Slight	Slight	Slight	Slight	Severe: low strength.
MbA, MbB: Manzanola	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
MmE*:					
Mathias	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Midway	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Rock outcrop.					
MnF*:					
Mathias	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rockoa	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop.					
MoB: Minnequa	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
MpE*:					
Minnequa	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.
Midway	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
MtA, MtB: Mitchell	Slight	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
NeD---------------- Nevee	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.
NoA---------------- Norka	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: frost action.
NoB, NoC----------- Norka	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.
NuA, NuB, NuC------ Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
OrE*: Orella------------	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Rock outcrop.					
PaD*: Paunsaugunt-------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Boneek------------	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
PbF*: Paunsaugunt-------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Vanocker----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
PeB---------------- Pierre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
PgE*: Pierre------------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Grummit-----------	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.
PsE*: Pierre------------	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Samsil------------	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
Pt*, Pu*. Pits					

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
ReD*:					
Rekop	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.
Tilford	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
Gystrum	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
RgF*:					
Rock outcrop.					
Gystrum	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
RoF*:					
Rock outcrop.					
Mathias	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Butche	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
RrF*:					
Rockoa	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop.					
SaE Samsil	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
SbD*:					
Samsil	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
Pierre	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
ScA Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.
ScB, ScC Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
SdA, SdB Savo	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
SmE*:					
Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
SmE*:					
Eckley	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
ShE*:					
Shingle	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Penrose	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
SpF*:					
Spearfish	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
SsE*:					
Spearfish	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Tilford	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.
St Stetter	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.
Sw Swanboy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
TaA, TaB Tilford	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
TaC Tilford	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
TgC*:					
Tilford	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
Gystrum	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
VaE Valent	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WpC*:					
Winler	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Pierre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
ZnE*:					
Zigweid----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Nihill-----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aa------------------ Absted	Severe: percs slowly.	Slight-----------	Severe: excess salt.	Slight-----------	Fair: thin layer.
AaC----------------- Alice	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
AbA, AbB------------ Altvan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ap*. Aquolls					
Ar------------------ Arvada	Severe: percs slowly.	Slight-----------	Slight-----------	Slight-----------	Good.
AsB----------------- Ascalon	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
AsC----------------- Ascalon	Slight-----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Ba*. Badland					
Bb------------------ Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
Bc------------------ Barnum	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
BoA----------------- Boneek	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
BoB----------------- Boneek	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
BpB----------------- Boneek	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: thin layer.
BrD----------------- Broadhurst	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: hard to pack, too clayey.
BuB----------------- Bufton	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Poor: hard to pack.
BvD*:					
Butche--------------	Severe: depth to rock.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim.
Boneek--------------	Moderate: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CnD*:					
Colby	Moderate: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Norka	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
DaB Dailey	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
DaC Dailey	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
DwA, DwB Dwyer	Severe: poor filter.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: seepage, too sandy.
DwE Dwyer	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy, seepage.	Severe: slope, seepage.	Poor: seepage, too sandy, slope.
EaC Eckley	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ga Glenberg	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
GrE*:					
Grummit	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, hard to pack, area reclaim.
Rock outcrop.					
GsD*:					
Grummit	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: hard to pack, area reclaim.
Snomo	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: hard to pack.
Ha Haverson	Moderate: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
HbB Haverson Variant	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Poor: small stones.
He*:					
Hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack, too clayey.
Slickspots.					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ho----------------- Hoven	Severe: percs slowly, ponding.	Slight-----------	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
JaB---------------- Jayem	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
KaB---------------- Kadoka	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
KeD*:					
Kadoka-------------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Epping-------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
KyA---------------- Kyle	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: hard to pack, too clayey.
KyB---------------- Kyle	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: hard to pack, too clayey.
Lo----------------- Lohmiller	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Poor: hard to pack.
MaA---------------- Manvel	Moderate: percs slowly.	Moderate: seepage.	Slight-----------	Slight-----------	Good.
MbA---------------- Manzanola	Severe: percs slowly.	Moderate: seepage.	Slight-----------	Slight-----------	Good.
MbB---------------- Manzanola	Severe: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
MmE*:					
Mathias------------	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Midway-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
MnF*:					
Mathias------------	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Rockoa-------------	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MoB: Minnequa	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
MpE*:					
Minnequa	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Midway	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
MtA: Mitchell	Slight	Moderate: seepage.	Slight	Slight	Good.
MtB: Mitchell	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
NeD: Nevee	Moderate: slope, depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Fair: slope, area reclaim, thin layer.
NoA: Norka	Slight	Moderate: seepage.	Slight	Slight	Good.
NoB: Norka	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
NoC: Norka	Slight	Severe: slope.	Slight	Slight	Good.
NuA: Nunn	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NuB: Nunn	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NuC:					
Nunn	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
OrE*:					
Orella	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
PaD*:					
Paunsaugunt	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones.
Boneek	Moderate: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PbF*:					
Paunsaugunt	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones.
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
PeB Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PgE*:					
Pierre	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Grummit	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, hard to pack, area reclaim.
PsE*:					
Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Samsil	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Pt*, Pu*. Pits					
ReD*:					
Rekop	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Tilford	Slight	Severe: slope.	Slight	Slight	Good.
Gystrum	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim.
RgF*:					
Rock outcrop.					
Gystrum	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, excess salt.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
RoF*:					
Rock outcrop.					
Mathias	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Butche	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RrF*:					
Rockoa	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Rock outcrop.					
SaE Samsil	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
SbD*:					
Samsil	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
ScA Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
ScB Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
ScC Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SdA Savo	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
SdB Savo	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SmE*:					
Schamber	Severe: slope, poor filter.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: small stones, seepage, too sandy.
Eckley	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
SnE*:					
Shingle	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Penrose	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Rock outcrop.					
SpF*:					
Spearfish	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SsE*:					
Spearfish	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Tilford	Moderate: slope, large stones.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
St: Stetter	Severe: percs slowly, flooding.	Severe: flooding.	Severe: too clayey, flooding.	Severe: flooding.	Poor: too clayey, hard to pack.
Sw: Swanboy	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
TaA: Tilford	Slight	Moderate: seepage.	Slight	Slight	Good.
TaB: Tilford	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
TaC: Tilford	Slight	Severe: slope.	Slight	Slight	Good.
TgC*:					
Tilford	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Gystrum	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim.
VaE: Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
WpC*:					
Winler	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim, hard to pack.
Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
ZnE*:					
Zigweid	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Nihill	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aa---Absted	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
AaC---Alice	Good.	Improbable: excess fines.	Improbable: excess fines.	Good.
AbA, AbB---Altvan	Good.	Probable.	Improbable: too sandy.	Fair: area reclaim, thin layer.
Ap*. Aquolls				
Ar---Arvada	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
AsB, AsC---Ascalon	Good.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ba*. Badland				
Bb---Bankard	Good.	Improbable: thin layer.	Improbable: too sandy.	Poor: area reclaim.
Bc---Barnum	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
BoA, BoB, BpB---Boneek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BrD---Broadhurst	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BuB---Bufton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
BvD*:				
Butche	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
Boneek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CnD*:				
Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Norka	Good.	Improbable: excess fines.	Improbable: excess fines.	Good.
DaB, DaC---Dailey	Good.	Probable.	Improbable: too sandy.	Poor: too sandy.
DwA, DwB---Dwyer	Good.	Probable.	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DwE: Dwyer	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
EaC: Eckley	Good	Probable	Probable	Poor: small stones, area reclaim.
Ga: Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
GrE*:				
Grummit	Poor: slope, area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
Rock outcrop.				
GsD*:				
Grummit	Poor: low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim.
Snomo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ha: Haverson	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
HbB: Haverson Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
He*:				
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, too clayey, excess salt.
Slickspots.				
Ho: Hoven	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
JaB: Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
KaB: Kadoka	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
KeD*:				
Kadoka	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Epping	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
KyA, KyB: Kyle	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Lo: Lohmiller	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MaA: Manvel	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
MbA, MbB: Manzanola	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MmE*:				
Mathias	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
MnF*:				
Mathias	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Rockoa	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Rock outcrop.				
MoB: Minnequa	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, large stones.
MpE*:				
Minnequa	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, large stones.
Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
MtA, MtB: Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
NeD: Nevee	Fair: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
NoA, NoB, NoC: Norka	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
NuA, NuB, NuC: Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
OrE*:				
Orella	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PaD*:				
Paunsaugunt	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Boneek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
PbF*:				
Paunsaugunt	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Vanocker	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
PeB Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PgE*:				
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Grummit	Poor: low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
PsE*:				
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
Pt*, Pu*. Pits				
ReD*:				
Rekop	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Gystrum	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
RgF*:				
Rock outcrop.				
Gystrum	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RoF*:				
Rock outcrop.				
Mathias	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Butche	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
RrF*:				
Rockoa	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Rock outcrop.				
SaE Samsil	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
SbD*:				
Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ScA, ScB, ScC Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
SdA, SdB Savo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
SmE*:				
Schamber	Poor: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
Eckley	Good	Probable	Probable	Poor: small stones, area reclaim.
SnE*:				
Shingle	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Penrose	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SpF*:				
Spearfish	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
SsE*:				
Spearfish	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones, slope.
St: Stetter	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Sw: Swanboy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
TaA, TaB, TaC: Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
TgC*:				
Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Gystrum	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
VaE: Valent	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
WpC*:				
Winler	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ZnE*:				
Zigweid	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Nihill	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Aa: Absted	Slight	Severe: excess salt.	Percs slowly	Erodes easily	Erodes easily, percs slowly.
AaC: Alice	Severe: seepage.	Severe: piping.	Soil blowing	Soil blowing	Favorable.
AbA: Altvan	Severe: seepage.	Severe: seepage.	Favorable	Too sandy	Favorable.
AbB: Altvan	Severe: seepage.	Severe: seepage.	Slope	Too sandy	Favorable.
Ap*. Aquolls					
Ar: Arvada	Slight	Slight	Droughty, percs slowly.	Percs slowly	Droughty, percs slowly.
AsB, AsC: Ascalon	Severe: seepage.	Severe: piping.	Droughty, soil blowing.	Soil blowing	Droughty.
Ba*. Badland					
Bb: Bankard	Severe: seepage.	Severe: seepage, piping.	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Bc: Barnum	Moderate: seepage.	Moderate: piping.	Flooding	Erodes easily	Erodes easily.
BoA: Boneek	Moderate: seepage.	Severe: piping.	Favorable	Erodes easily	Erodes easily.
BoB: Boneek	Moderate: seepage, slope.	Severe: piping.	Slope	Erodes easily	Erodes easily.
BpB: Boneek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Slope	Erodes easily	Erodes easily.
BrD: Broadhurst	Severe: slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
BuB: Bufton	Moderate: slope.	Moderate: hard to pack.	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
BvD*:					
Butche	Severe: depth to rock, slope.	Severe: large stones.	Large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope.
Boneek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Slope	Erodes easily	Erodes easily.
CnD*:					
Colby	Severe: slope.	Severe: piping.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
CnD*:					
Norka	Moderate: seepage, slope.	Severe: piping.	Slope	Favorable	Favorable.
DaB Dailey	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DaC Dailey	Severe: seepage, slope.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
DwA, DwB Dwyer	Severe: seepage.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DwE Dwyer	Severe: seepage, slope.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
EaC Eckley	Severe: seepage.	Severe: seepage.	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
Ga Glenberg	Severe: seepage.	Severe piping.	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
GrE*:					
Grummit	Severe: depth to rock, slope.	Severe: hard to pack.	Slow intake, depth to rock, droughty.	Slope, depth to rock.	Slope, depth to rock, droughty.
Rock outcrop.					
GsD*:					
Grummit	Severe: depth to rock, slope.	Severe: hard to pack.	Slow intake, depth to rock, droughty.	Slope, depth to rock.	Slope, depth to rock, droughty.
Snomo	Severe: slope.	Severe: hard to pack.	Droughty, slow intake, slope.	Slope	Slope, droughty.
Ha Haverson	Moderate: seepage.	Severe: piping.	Flooding	Too sandy	Favorable.
HbB Haverson Variant	Severe: slope.	Severe: piping.	Slope	Slope	Slope.
He*:					
Hisle	Moderate: depth to rock.	Severe: hard to pack.	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess salt, excess sodium.
Slickspots.					
Ho Hoven	Slight	Severe: hard to pack, ponding, excess sodium.	Ponding, percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Percs slowly, wetness, excess sodium.
JaB Jayem	Severe: seepage.	Severe: piping.	Soil blowing, slope.	Soil blowing	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
KaB: Kadoka	Moderate: slope, seepage, depth to rock.	Severe: thin layer.	Slope, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
KeD*:					
Kadoka	Severe: slope.	Severe: thin layer.	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Epping	Severe: depth to rock, slope.	Severe: piping.	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
KyA: Kyle	Slight	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
KyB: Kyle	Moderate: slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
Lo: Lohmiller	Slight	Moderate: hard to pack.	Percs slowly	Percs slowly	Percs slowly.
MaA: Manvel	Moderate: seepage.	Severe: piping.	Erodes easily	Erodes easily	Erodes easily.
MbA: Manzanola	Moderate: seepage.	Moderate: thin layer.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MbB: Manzanola	Moderate: seepage, slope.	Moderate: thin layer.	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MmE*:					
Mathias	Severe: seepage, slope.	Severe: large stones.	Large stones, slope.	Large stones, slope.	Large stones, slope.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Rock outcrop.					
MnF*:					
Mathias	Severe: seepage, slope.	Severe: large stones.	Large stones, soil blowing, slope.	Slope, large stones, soil blowing.	Large stones, slope.
Rockoa	Severe: seepage, slope.	Severe: piping, large stones.	Large stones, slope.	Slope, large stones.	Large stones, slope.
Rock outcrop.					
MoB: Minnequa	Moderate: seepage, depth to rock, slope.	Severe: piping.	Depth to rock, slope.	Depth to rock	Depth to rock.
MpE*:					
Minnequa	Severe: slope.	Severe: piping.	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
MpE*:					
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
MtA, MtB: Mitchell	Moderate: seepage.	Severe: piping.	Erodes easily	Erodes easily	Erodes easily.
NeD: Nevee	Severe: slope.	Severe: piping.	Slope	Slope, erodes easily.	Slope, erodes easily.
NoA: Norka	Moderate: seepage.	Severe: piping.	Favorable	Favorable	Favorable.
NoB, NoC: Norka	Moderate: seepage, slope.	Severe: piping.	Slope	Favorable	Favorable.
NuA, NuB, NuC: Nunn	Moderate: seepage.	Moderate: hard to pack.	Percs slowly	Percs slowly	Percs slowly.
OrE*:					
Orella	Severe: depth to rock, slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, percs slowly.	Slope, droughty, depth to rock.
Rock outcrop.					
PaD*:					
Paunsaugunt	Severe: depth to rock, slope.	Severe: thin layer.	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Boneek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Slope	Erodes easily	Erodes easily.
PbF*:					
Paunsaugunt	Severe: depth to rock, slope.	Severe: thin layer.	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Vanocker	Severe: slope.	Moderate: piping, large stones.	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.					
PeB: Pierre	Moderate: depth to rock, slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
PgE*:					
Pierre	Severe: slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Grummit	Severe: depth to rock, slope.	Severe: hard to pack.	Slow intake, depth to rock, droughty.	Slope, depth to rock.	Slope, depth to rock, droughty.
PsE*:					
Pierre	Severe: slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
PsE*:					
Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Pt*, Pu*. Pits					
ReD*:					
Rekop	Severe: depth to rock, slope.	Severe: piping.	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Tilford	Moderate: seepage, slope.	Severe: piping.	Slope	Erodes easily	Erodes easily.
Gystrum	Severe: slope.	Severe: piping, excess salt.	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
RgF*:					
Rock outcrop.					
Gystrum	Severe: slope.	Severe: piping, excess salt.	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
RoF*:					
Rock outcrop.					
Mathias	Severe: seepage, slope.	Severe: large stones.	Large stones, soil blowing, slope.	Slope, large stones, soil blowing.	Large stones, slope.
Butche	Severe: depth to rock, slope.	Severe: large stones.	Large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope.
RrF*:					
Rockoa	Severe: seepage, slope.	Severe: piping, large stones.	Large stones, slope.	Slope, large stones.	Large stones, slope.
Rock outcrop.					
SaE Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SbD*:					
Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Pierre	Severe: slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
ScA Satanta	Moderate: seepage.	Severe: piping.	Favorable	Favorable	Favorable.
ScB, ScC Satanta	Moderate: seepage, slope.	Severe: piping.	Slope	Favorable	Favorable.
SdA Savo	Slight	Moderate: hard to pack.	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
SdB----------------- Savo	Moderate: slope.	Moderate: hard to pack.	Slope-------------	Erodes easily----	Erodes easily.
SmE*:					
Schamber----------	Severe: slope, seepage.	Severe: seepage.	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Eckley------------	Severe: seepage, slope.	Severe: seepage.	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
SnE*:					
Shingle-----------	Severe: depth to rock, slope.	Severe: thin layer.	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Penrose-----------	Severe: depth to rock, slope.	Severe: piping.	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.					
SpF*:					
Spearfish---------	Severe: depth to rock, slope.	Severe: piping.	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.					
SsE*:					
Spearfish---------	Severe: depth to rock, slope.	Severe: piping.	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Tilford-----------	Severe: slope.	Severe: piping.	Slope, large stones.	Slope, erodes easily.	Slope, erodes easily.
St----------------- Stetter	Slight------------	Severe: hard to pack.	Slow intake, percs slowly, flooding.	Percs slowly, erodes easily.	Percs slowly, erodes easily, droughty.
Sw----------------- Swanboy	Slight------------	Severe: hard to pack.	Slow intake, percs slowly, excess salt.	Percs slowly, erodes easily.	Erodes easily, percs slowly, excess salt.
TaA, TaB----------- Tilford	Moderate: seepage.	Severe: piping.	Favorable---------	Erodes easily----	Erodes easily.
TaC---------------- Tilford	Moderate: seepage, slope.	Severe: piping.	Slope-------------	Erodes easily----	Erodes easily.
TgC*:					
Tilford-----------	Moderate: seepage.	Severe: piping.	Favorable---------	Erodes easily----	Erodes easily.
Gystrum-----------	Moderate: seepage, depth to rock, slope.	Severe: piping, excess salt.	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
VaE---------------- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
WpC*:					
Winler	Moderate: slope, depth to rock.	Severe: thin layer, hard to pack.	Slow intake, droughty, percs slowly.	Depth to rock, erodes easily.	Depth to rock, erodes easily.
Pierre	Moderate: depth to rock, slope.	Severe: hard to pack.	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
ZnE*:					
Zigweid	Severe: slope.	Slight	Slope	Slope, erodes easily.	Slope, erodes easily.
Nihill	Severe: seepage, slope.	Severe: seepage.	Droughty, slope.	Slope	Slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Aa-----------------	0-8	Silt loam---------	ML	A-4	0	85-100	85-100	75-95	50-65	15-20	NP-5
Absted	8-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0	85-100	85-100	80-100	75-95	30-60	15-30
AaC----------------	0-10	Fine sandy loam	SM, ML	A-4	0	100	95-100	95-100	45-60	20-30	NP-7
Alice	10-22	Fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	95-100	45-65	<25	NP-5
	22-40	Fine sandy loam, very fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	95-100	95-100	45-65	<25	NP-5
	40-60	Loamy fine sand, loamy very fine sand, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	95-100	55-100	25-60	<25	NP-5
AbA, AbB-----------	0-9	Loam--------------	ML	A-4	0	100	100	85-100	60-90	25-35	2-10
Altvan	9-24	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	24-33	Loam, silt loam, fine sandy loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	2-10
	33-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	70-90	25-35	0-10	---	NP
Ap*. Aquolls											
Ar-----------------	0-1	Loam--------------	CL-ML	A-4	0	90-100	90-100	85-95	60-75	15-25	5-10
Arvada	1-14	Clay, silty clay loam, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-65	20-35
	14-60	Clay loam, silty clay loam, clay.	CL	A-7	0	80-100	75-100	70-100	55-80	40-45	20-25
AsB, AsC-----------	0-7	Fine sandy loam	SM, SM-SC	A-2, A-4	0	95-100	90-100	70-95	25-45	15-25	NP-5
Ascalon	7-19	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	19-27	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-65	20-40	5-15
	27-60	Fine sandy loam, loamy fine sand.	SM	A-2, A-4	0	95-100	95-100	70-95	20-35	---	NP
Ba*. Badland											
Bb-----------------	0-5	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	65-85	45-60	---	NP
Bankard	5-60	Stratified sandy loam to sand.	SP-SM, SM	A-2, A-3, A-1	0-5	80-100	75-100	40-70	5-35	---	NP
Bc-----------------	0-5	Silt loam---------	ML	A-4	0	85-100	85-100	85-100	70-90	30-35	5-10
Barnum	5-60	Stratified clay loam to fine sandy loam.	CL	A-6	0	85-100	85-100	70-95	50-75	30-35	10-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BoA, BoB--------- Boneek	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	6-15	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	100	85-100	35-50	11-25
	15-23	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	100	85-100	30-45	8-20
	23-60	Silty clay loam, silt loam, loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
BpB-------------- Boneek	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	7-20	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	100	85-100	35-50	11-25
	20-41	Silty clay loam, silt loam, loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BrD-------------- Broadhurst	0-60	Clay-------------	MH, CH, CL	A-7	0	100	100	95-100	80-100	45-70	20-35
BuB-------------- Bufton	0-3	Silty clay loam	CL, CH	A-7	0	100	100	80-100	80-95	40-60	20-30
	3-24	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	100	80-100	80-95	40-60	20-30
	24-60	Silty clay loam, silt loam, silty clay.	CL, CH	A-7	0	100	100	80-100	80-95	40-60	20-30
BvD*: Butche----------	0-4	Fine sandy loam	SM	A-4	0-15	85-100	80-100	75-100	35-50	20-35	NP-10
	4-9	Stony loam, fine sandy loam, channery fine sandy loam.	ML, CL, SM, SC	A-4, A-6	10-50	75-100	65-100	60-100	35-65	25-40	3-15
	9-12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Boneek----------	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	7-20	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	100	85-100	35-50	11-25
	20-41	Silty clay loam, silt loam, loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CnD*: Colby-----------	0-4	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	4-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Norka-----------	0-7	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
	7-15	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	15-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	85-95	20-30	NP-10
DaB, DaC--------- Dailey	0-14	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	80-95	5-25	---	NP
	14-60	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	75-95	5-35	---	NP
DwA, DwB, DwE---- Dwyer	0-6	Loamy fine sand	SM	A-2	0	100	100	65-80	20-35	---	NP
	6-60	Fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2	0	85-100	75-100	50-80	5-35	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
EaC-------------- Eckley	0-4	Loam------------	SC, CL, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	75-90	35-55	25-35	5-15
	4-12	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	55-85	50-75	30-65	20-55	25-40	10-20
	12-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
Ga--------------- Glenberg	0-6	Fine sandy loam	SM, SM-SC	A-4, A-2	0	95-100	85-100	60-80	30-45	20-30	NP-7
	6-60	Stratified loamy sand to loam.	SM	A-2, A-4	0	90-100	75-100	50-70	25-40	<25	NP-5
GrE*:											
Grummit---------	0-4	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-11	Shaly clay-------	CH, MH, ML, CL	A-7	0	95-100	85-100	75-100	65-100	40-60	10-30
	11-60	Unweathered bedrock.	CH, MH, ML, CL	A-7	0	95-100	95-100	90-100	80-100	40-60	10-30
Rock outcrop.											
GsD*:											
Grummit---------	0-4	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-11	Shaly clay-------	CH, MH, ML, CL	A-7	0	95-100	85-100	75-100	65-100	40-60	10-30
	11-60	Unweathered bedrock.	CH, MH, ML, CL	A-7	0	95-100	95-100	90-100	80-100	40-60	10-30
Snomo-----------	0-7	Clay-------------	MH, CH	A-7	0	100	95-100	95-100	90-100	50-70	20-38
	7-45	Clay-------------	CH, MH	A-7	0	95-100	95-100	95-100	90-100	50-70	20-38
	45-60	Shaly clay-------	CH, MH	A-7	0	60-75	55-75	55-75	50-70	50-70	20-38
Ha--------------- Haverson	0-6	Loam-------------	ML, CL-ML	A-4, A-6	0	95-100	90-100	85-100	55-70	25-35	NP-10
	6-60	Stratified clay loam to sand.	CL, ML, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15
HbB-------------- Haverson Variant	0-3	Loam-------------	CL, ML	A-4, A-6	0	95-100	90-100	80-95	50-75	30-40	5-15
	3-60	Stratified gravelly loam to sandy loam.	GM, GC, SM, SC	A-4, A-6, A-1, A-2	0-5	50-95	35-55	25-50	15-45	30-40	5-15
He*:											
Hisle-----------	0-1	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-29	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	29-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
Slickspots.											
Ho--------------- Hoven	0-2	Silt loam--------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	2-6	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	6-30	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	30-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
JaB-------------- Jayem	0-13	Fine sandy loam	SM	A-4, A-2	0	100	95-100	80-100	30-45	15-25	NP-5
	13-30	Fine sandy loam, very fine sandy loam.	SM, ML	A-4, A-2	0	100	95-100	80-100	30-55	15-25	NP-5
	30-60	Loamy fine sand, fine sand.	SM	A-2	0	100	95-100	50-80	10-35	15-25	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
KaB-------------- Kadoka	0-4	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	5-15
	4-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	65-100	35-50	10-25
	13-36	Silt loam, loam	CL, ML	A-4, A-6, A-7	0-5	85-100	70-100	60-100	55-100	30-45	5-20
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
KeD*:											
Kadoka----------	0-4	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	5-15
	4-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	65-100	35-50	10-25
	13-36	Silt loam, loam	CL, ML	A-4, A-6, A-7	0-5	85-100	70-100	60-100	55-100	30-45	5-20
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Epping----------	0-4	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	70-85	15-30	2-10
	4-17	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	15-35	2-15
	17-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
KyA, KyB--------- Kyle	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
	4-60	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	29-55
Lo--------------- Lohmiller	0-4	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	4-8	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	12-30
	8-60	Stratified fine sandy loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	65-95	35-60	12-30
MaA-------------- Manvel	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	70-90	25-35	5-15
	5-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0	95-100	95-100	95-100	80-90	20-40	5-20
MbA, MbB--------- Manzanola	0-7	Silty clay loam	CL	A-6	0-5	95-100	85-100	80-100	65-85	30-40	10-20
	7-25	Clay loam, clay, silty clay.	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-90	35-50	20-30
	25-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	80-95	60-90	30-40	10-20
MmE*:											
Mathias---------	0-2	Extremely stony very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	85-100	75-90	65-85	45-60	30-40	5-15
	2-13	Fine sandy loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	85-100	70-90	60-85	35-60	20-35	3-12
	13-33	Fine sandy loam, sandy clay loam, very fine sandy loam.	SC, SM, ML, CL	A-4, A-6	30-60	85-100	75-90	60-85	35-55	30-40	7-15
	33-60	Fine sandy loam, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-4, A-6	30-70	85-100	75-90	55-75	35-50	20-35	3-12
Midway----------	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-16	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	35-60	20-35
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
MnF*:											
Mathias	0-2	Extremely stony very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	85-100	75-90	65-85	45-60	30-40	5-15
	2-13	Fine sandy loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	85-100	70-90	60-85	35-60	20-35	3-12
	13-33	Fine sandy loam, sandy clay loam, very fine sandy loam.	SC, SM, ML, CL	A-4, A-6	30-60	85-100	75-90	60-85	35-55	30-40	7-15
	33-60	Fine sandy loam, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-4, A-6	30-70	85-100	75-90	55-75	35-50	20-35	3-12
Rockoa	0-5	Extremely stony fine sandy loam.	SM, SC, SM-SC	A-4	20-50	80-100	70-90	65-85	35-50	20-30	3-10
	5-10	Fine sandy loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	80-100	70-90	65-85	40-60	20-35	3-12
	10-32	Fine sandy loam, sandy clay loam, clay loam.	SC, SM, CL, ML	A-4, A-6	30-60	70-100	65-90	60-85	35-60	30-40	5-15
	32-60	Fine sandy loam, sandy clay loam, loam.	SM, SC, SM-SC, GM	A-4, A-6	30-70	70-100	65-85	55-75	35-50	20-35	3-12
Rock outcrop.											
MoB Minnequa	0-4	Silt loam	ML, CL-ML	A-4	0-1	95-100	95-100	80-100	65-90	20-30	NP-10
	4-24	Silt loam, loam, silty clay loam.	ML, CL-ML	A-4	0-5	95-100	95-100	90-100	80-90	20-30	NP-10
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
MpE*:											
Minnequa	0-4	Silty clay loam	CL, CL-ML	A-4	0-1	95-100	95-100	80-100	65-90	20-40	5-15
	4-24	Silt loam, loam, silty clay loam.	ML, CL-ML	A-4	0-5	95-100	95-100	90-100	80-90	20-30	NP-10
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-16	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	35-60	20-35
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
MtA, MtB Mitchell	0-11	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-95	65-95	20-35	2-10
	11-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	65-100	20-35	2-10
NeD Nevee	0-8	Silt loam	ML	A-4	0	100	100	95-100	80-100	20-30	NP-5
	8-43	Silt loam, loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	20-35	5-15
	43-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
NoA, NoB, NoC Norka	0-7	Silt loam	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
	7-15	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	15-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	85-95	20-30	NP-10
NuA, NuB, NuC Nunn	0-8	Clay loam	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	8-25	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	25-60	Clay loam, loam, sandy loam.	CL, SC	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
OrE*:											
Orella----------	0-2	Silty clay--------	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	2-18	Clay, clay loam	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	18-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
PaD*:											
Paunsaugunt-----	0-8	Gravelly loam----	GM-GC	A-4	0-5	50-65	50-65	45-55	40-50	20-30	5-10
	8-14	Cobbly sandy loam, channery loam, cobbly loam.	SM, SM-SC	A-1, A-2, A-4	20-35	75-85	70-80	40-60	20-50	15-25	NP-10
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Boneek----------	0-7	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	7-20	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	100	85-100	35-50	11-25
	20-41	Silty clay loam, silt loam, loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
PbF*:											
Paunsaugunt-----	0-8	Gravelly loam----	GM-GC	A-4	0-5	50-65	50-65	45-55	40-50	20-30	5-10
	8-14	Cobbly sandy loam, channery loam, cobbly loam.	SM, SM-SC	A-1, A-2, A-4	20-35	75-85	70-80	40-60	20-50	15-25	NP-10
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Vanocker---------	0-3	Gravelly loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	70-90	60-80	50-80	45-70	30-45	5-20
	3-60	Gravelly loam, channery loam.	CL, SC, GC	A-6, A-7	0-25	70-90	55-85	40-80	35-75	30-45	10-20
Rock outcrop.											
PeB-------------- Pierre	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-20	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	20-34	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	34-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
PgE*:											
Pierre-----------	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-20	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	20-34	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	34-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
Grummit----------	0-4	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-11	Shaly clay--------	CH, MH, ML, CL	A-7	0	95-100	85-100	75-100	65-100	40-60	10-30
	11-60	Unweathered bedrock.	CH, MH, ML, CL	A-7	0	95-100	95-100	90-100	80-100	40-60	10-30
PsE*:											
Pierre-----------	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-20	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	20-34	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	34-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
Samsil-----------	0-3	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	18-50
	3-18	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	18-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Pt*, Pu*. Pits											
ReD*: Rekop	0-4	Loam	ML	A-4	0-5	95-100	95-100	85-95	60-75	30-35	5-10
	4-15	Gravelly loam, loam.	GM, ML	A-4	0-10	60-100	55-95	45-80	35-65	30-35	5-10
	15-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Tilford	0-4	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	4-18	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	18-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
Gystrum	0-3	Silty clay loam	ML	A-6	0	95-100	90-100	90-100	85-95	35-40	10-15
	3-28	Silty clay loam, silt loam.	ML	A-4, A-6	0	95-100	95-100	90-100	85-95	30-40	5-15
	28-35	Unweathered bedrock.	---	---	---	---	90-100	---	---	---	---
RgF*: Rock outcrop.											
Gystrum	0-3	Silty clay loam	ML	A-6	0	95-100	90-100	90-100	85-95	35-40	10-15
	3-28	Silty clay loam, silt loam.	ML	A-4, A-6	0	95-100	95-100	90-100	85-95	30-40	5-15
	28-35	Unweathered bedrock.	---	---	---	---	90-100	---	---	---	---
RoF*: Rock outcrop.											
Mathias	0-2	Extremely stony very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	85-100	75-90	65-85	45-60	30-40	5-15
	2-13	Fine sandy loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	85-100	70-90	60-85	35-60	20-35	3-12
	13-33	Fine sandy loam, sandy clay loam, very fine sandy loam.	SC, SM, ML, CL	A-4, A-6	30-60	85-100	75-90	60-85	35-55	30-40	7-15
	33-60	Fine sandy loam, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-4, A-6	30-70	85-100	75-90	55-75	35-50	20-35	3-12
Butche	0-4	Fine sandy loam	SM	A-4	0-15	85-100	80-100	75-100	35-50	20-35	NP-10
	4-9	Stony loam, fine sandy loam, channery fine sandy loam.	ML, CL, SM, SC	A-4, A-6	10-50	75-100	65-100	60-100	35-65	25-40	3-15
	9-12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RrF*: Rockoa	0-5	Extremely stony fine sandy loam.	SM, SC, SM-SC	A-4	20-50	80-100	70-90	65-85	35-50	20-30	3-10
	5-10	Fine sandy loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	20-50	80-100	70-90	65-85	40-60	20-35	3-12
	10-32	Fine sandy loam, sandy clay loam, clay loam.	SC, SM, CL, ML	A-4, A-6	30-60	70-100	65-90	60-85	35-60	30-40	5-15
	32-60	Fine sandy loam, sandy clay loam, loam.	SM, SC, SM-SC, GM	A-4, A-6	30-70	70-100	65-85	55-75	35-50	20-35	3-12
Rock outcrop.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SaE------------ Samsil	0-3	Clay------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	18-50
	3-18	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	18-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
SbD*:											
Samsil----------	0-3	Clay------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	18-50
	3-18	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	18-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Pierre----------	0-4	Clay------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-20	Clay------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	20-34	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	34-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
ScA, ScB, ScC---- Satanta	0-8	Loam------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	8-20	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	20-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
SdA, SdB--------- Savo	0-5	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	5-20
	5-16	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	16-42	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-95	40-55	15-30
	42-60	Silty clay loam, silt loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-100	35-55	12-30
SmE*:											
Schamber--------	0-6	Gravelly loam----	SM, SW-SM, GM, GW-GM	A-2, A-1	0-5	55-90	40-75	30-60	10-35	<25	NP-5
	6-60	Gravelly sand, very gravelly sand, gravelly loamy sand.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-60	15-40	5-20	0-10	<25	NP-5
Eckley----------	0-4	Loam------------	SC, CL, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	75-90	35-55	25-35	5-15
	4-12	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	55-85	50-75	30-65	20-55	25-40	10-20
	12-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
SnE*:											
Shingle---------	0-3	Loam------------	ML	A-4	0-5	75-100	75-100	70-95	55-75	25-35	NP-10
	3-17	Clay loam, loam	CL	A-6	0	75-100	75-100	65-100	50-80	30-40	10-20
	17-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Penrose---------	0-13	Loam------------	ML, CL-ML	A-4	0-10	90-100	75-95	60-90	50-70	15-30	NP-10
	13-37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
SpF*:											
Spearfish-------	0-4	Loam------------	ML, CL	A-4, A-6	0	100	100	85-100	65-90	25-40	NP-15
	4-17	Loam, shaly loam	ML, CL	A-4, A-6	0	90-100	70-100	65-100	50-90	25-40	NP-15
	17-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SsE*:											
Spearfish-------	0-4	Extremely stony loam.	ML, CL	A-4, A-6	20-50	95-100	95-100	85-100	50-90	25-40	NP-15
	4-17	Loam, shaly loam	ML, CL	A-4, A-6	0	90-100	70-100	65-100	50-90	25-40	NP-15
	17-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tilford---------	0-4	Extremely stony loam.	CL-ML, CL, ML	A-4, A-6	20-50	95-100	90-100	80-100	50-95	22-35	3-15
	4-18	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0-5	100	100	95-100	60-95	22-35	3-15
	18-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
St---------------	0-6	Clay-------------	CH	A-7	0	100	100	90-100	75-100	50-90	25-65
Stetter	6-60	Clay-------------	CH	A-7	0	100	100	90-100	75-100	50-90	25-65
Sw---------------	0-6	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
Swanboy	6-60	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
TaA, TaB, TaC----	0-4	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
Tilford	4-18	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	18-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
TgC*:											
Tilford---------	0-4	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	4-18	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	18-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
Gystrum---------	0-3	Silty clay loam	ML	A-6	0	95-100	90-100	90-100	85-95	35-40	10-15
	3-28	Silty clay loam, silt loam.	ML	A-4, A-6	0	95-100	95-100	90-100	85-95	30-40	5-15
	28-60	Unweathered bedrock.	---	---	---	---	90-100	---	---	---	---
VaE--------------	0-7	Loamy fine sand	SM, SP-SM	A-2	0	100	100	80-95	10-30	---	NP
Valent	7-60	Sand-------------	SP, SP-SM	A-3	0	100	95-100	70-90	0-10	---	NP
WpC*:											
Winler----------	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	65-95	30-55
	4-20	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	65-90	30-55
	20-30	Shaly clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	65-90	30-55
	30-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	65-90	30-55
Pierre----------	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-20	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	20-34	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	34-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
ZnE*:											
Zigweid---------	0-6	Clay loam--------	CL	A-6	0	75-100	75-100	65-100	50-80	25-40	15-20
	6-60	Loam, clay loam	CL	A-6	0	75-100	75-100	65-100	50-80	25-40	15-20
Nihill----------	0-7	Gravelly loam----	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	7-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM	A-2, A-1	0-15	30-60	20-50	15-40	10-35	20-35	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	In/hr	In/in	pH	Mmhos/cm					Pct
Aa	0-8	2.0-6.0	0.15-0.17	6.6-7.8	<2	Low	0.32	4	4	1-3
Absted	8-60	0.06-0.2	0.11-0.13	>7.4	<8	High	0.32			
AaC	0-10	0.6-6.0	0.16-0.22	6.6-8.4	<2	Low	0.20	5	3	2-4
Alice	10-22	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low	0.20			
	22-40	0.6-6.0	0.08-0.19	7.4-8.4	<2	Low	0.20			
	40-60	2.0-6.0	0.08-0.19	7.4-8.4	<2	Low	0.20			
AbA, AbB	0-9	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low	0.32	4	5	2-4
Altvan	9-24	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	24-33	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low	0.32			
	33-60	>20	0.02-0.04	7.4-9.0	<2	Low	0.10			
Ap*.										
Aquolls										
Ar	0-1	0.6-2.0	0.16-0.18	6.6-9.0	<4	Low	0.32	1	5	.5-1
Arvada	1-14	<0.06	0.07-0.09	>7.8	<4	High	0.32			
	14-60	0.06-0.2	0.09-0.11	>7.8	>8	High	0.32			
AsB, AsC	0-7	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.17	5	3	2-4
Ascalon	7-19	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.24			
	19-27	0.6-6.0	0.11-0.15	7.4-8.4	<2	Low	0.24			
	27-60	2.0-6.0	0.06-0.13	7.4-8.4	<2	Low	0.17			
Ba*.										
Badland										
Bb	0-5	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	0.17	5	3	.5-2
Bankard	5-60	6.0-20	0.06-0.08	7.4-8.4	<2	Low	0.10			
Bc	0-5	0.6-2.0	0.19-0.21	7.4-9.0	4-8	Low	0.43	5	4L	1-3
Barnum	5-60	0.6-2.0	0.16-0.18	7.4-9.0	4-8	Low	0.28			
BoA, BoB	0-6	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low	0.32	5	6	2-4
Boneek	6-15	0.2-0.6	0.11-0.17	6.1-7.8	<2	Moderate	0.43			
	15-23	0.6-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.43			
	23-60	0.6-2.0	0.16-0.20	7.4-9.0	<4	Low	0.43			
BpB	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low	0.32	5	6	2-4
Boneek	7-20	0.2-0.6	0.11-0.17	6.1-7.8	<2	Moderate	0.43			
	20-41	0.6-2.0	0.16-0.20	7.4-9.0	<4	Low	0.43			
	41-60	---	---	---	---	---	---			
BrD	0-4	<0.06	0.08-0.12	3.6-6.0	<2	Very high	0.37	5	4	1-3
Broadhurst	4-60	<0.06	0.08-0.12	3.6-6.0	4-16	Very high	0.37			
BuB	0-3	0.06-0.6	0.18-0.23	6.6-8.4	<2	High	0.37	5	4L	.5-1
Bufton	3-24	0.06-0.6	0.12-0.20	7.4-9.0	<2	High	0.37			
	24-60	0.06-0.6	0.10-0.18	7.9-9.0	<2	High	0.37			
BvD*:										
Butche	0-4	2.0-6.0	0.14-0.17	6.1-7.3	<2	Low	0.24	2	3	1-3
	4-9	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low	0.24			
	9-12	---	---	---	---	---	---			
Boneek	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low	0.32	5	6	2-4
	7-20	0.2-0.6	0.11-0.17	6.1-7.8	<2	Moderate	0.43			
	20-41	0.6-2.0	0.16-0.20	7.4-9.0	<4	Low	0.43			
	41-60	---	---	---	---	---	---			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	In/hr	In/in	pH	Mmhos/cm					Pct
CnD*:										
Colby	0-4	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.43	5	4L	.5-2
	4-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
Norka	0-7	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low	0.32	5	5	2-3
	7-15	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	15-60	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low	0.32			
DaB, DaC Dailey	0-14	6.0-20	0.05-0.07	6.6-7.3	<2	Low	0.17	5	1	1-3
	14-60	6.0-20	0.04-0.07	6.6-7.8	<2	Low	0.10			
DwA, DwB, DwE Dwyer	0-6	6.0-20	0.08-0.11	6.1-8.4	<2	Low	0.32	5	2	.5-1
	6-60	6.0-20	0.04-0.11	7.9-8.4	<2	Low	0.32			
EaC Eckley	0-4	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.15	4	3	2-3
	4-12	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	12-60	>6.0	0.03-0.06	6.6-7.8	<2	Low	0.10			
Ga Glenberg	0-6	2.0-6.0	0.11-0.14	7.4-8.4	<2	Low	0.24	5	3	.5-2
	6-60	2.0-6.0	0.07-0.12	7.4-8.4	<2	Low	0.10			
GrE*:										
Grummit	0-4	0.2-0.6	0.08-0.12	3.6-5.5	<2	High	0.28	2	4	1-2
	4-11	0.6-2.0	0.08-0.12	3.6-5.5	<2	High	0.28			
	11-60	---	---	3.6-5.5	---	---	----			
Rock outcrop.										
GsD*:										
Grummit	0-4	0.2-0.6	0.08-0.12	3.6-5.5	<2	High	0.28	2	4	1-2
	4-11	0.6-2.0	0.08-0.12	3.6-5.5	<2	High	0.28			
	11-60	---	---	3.6-5.5	---	---	----			
Snomo	0-7	0.6-2.0	0.10-0.14	3.6-6.5	<2	High	0.28	4	4	2-4
	7-45	0.6-2.0	0.08-0.12	3.6-5.5	<2	High	0.28			
	45-60	0.6-2.0	0.08-0.12	3.6-5.0	<2	High	0.28			
Ha Haverson	0-6	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low	0.28	5	4L	1-3
	6-60	0.6-2.0	0.14-0.18	7.4-9.0	2-4	Low	0.28			
HbB Haverson Variant	0-3	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low	0.28	5	6	1-3
	3-60	0.6-2.0	0.14-0.16	7.4-8.4	<2	Low	0.20			
He*:										
Hisle	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low	0.28	1	6	1-3
	1-29	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	29-60	---	---	6.1-8.4	---	---	----			
Slickspots.										
Ho Hoven	0-2	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.37	1	7	2-4
	2-6	<0.06	0.10-0.19	6.1-7.8	4-16	High	0.37			
	6-30	<0.06	0.10-0.19	7.4-8.4	4-16	High	0.37			
	30-60	<0.2	0.08-0.17	7.4-9.0	4-16	High	0.37			
JaB Jayem	0-13	2.0-6.0	0.12-0.15	6.6-7.8	<2	Low	0.20	5	3	2-4
	13-30	2.0-6.0	0.12-0.15	6.6-7.8	<2	Low	0.20			
	30-60	2.0-6.0	0.06-0.10	6.6-7.8	<2	Low	0.20			
KaB Kadoka	0-4	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low	0.32	4	6	2-4
	4-13	0.6-2.0	0.18-0.21	6.6-7.8	<2	Moderate	0.43			
	13-36	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low	0.43			
	36-60	---	---	---	---	---	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	In/hr	In/in	pH	Mmhos/cm					Pct
KeD*:										
Kadoka----------	0-4	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low----------	0.32	4	6	2-4
	4-13	0.6-2.0	0.18-0.21	6.6-7.8	<2	Moderate----	0.43			
	13-36	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low----------	0.43			
	36-60	---	---	---	---	------------	----			
Epping----------	0-4	0.6-2.0	0.21-0.23	6.6-8.4	<2	Low----------	0.43	2	4L	.5-1
	4-17	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low----------	0.43			
	17-60	---	---	---	---	------------	----			
KyA, KyB--------- Kyle	0-4	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
	4-60	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
Lo--------------- Lohmiller	0-4	0.06-0.6	0.14-0.17	6.6-8.4	<4	Moderate----	0.32	5	4	1-3
	4-8	0.06-0.6	0.11-0.16	6.6-8.4	<4	High--------	0.32			
	8-60	0.06-0.6	0.14-0.16	7.4-8.4	<8	High--------	0.32			
MaA-------------- Manvel	0-5	0.6-2.0	0.18-0.20	7.9-8.4	<2	Low----------	0.37	5	4L	.5-2
	5-60	0.6-2.0	0.16-0.18	7.9-8.4	2-4	Low----------	0.43			
MbA, MbB--------- Manzanola	0-7	0.2-0.6	0.18-0.20	7.4-8.4	<4	Moderate----	0.37	5	4L	1-2
	7-25	0.06-0.2	0.15-0.18	7.4-8.4	<2	High--------	0.28			
	25-60	0.2-0.6	0.16-0.18	7.4-9.0	<8	Moderate----	0.24			
MmE*:										
Mathias---------	0-2	0.6-2.0	0.15-0.17	6.1-7.8	<2	Low----------	0.24	5	8	1-2
	2-13	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low----------	0.17			
	13-33	0.6-2.0	0.14-0.18	6.1-7.8	<2	Low----------	0.17			
	33-60	0.6-6.0	0.13-0.17	6.6-8.4	<2	Low----------	0.17			
Midway----------	0-4	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate----	0.43	1	4L	.5-2
	4-16	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High--------	0.43			
	16-60	---	---	---	---	------------	----			
Rock outcrop.										
MnF*:										
Mathias---------	0-2	2.0-6.0	0.11-0.14	6.1-7.8	<2	Low----------	0.17	5	8	1-2
	2-13	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low----------	0.17			
	13-33	0.6-2.0	0.14-0.18	6.1-7.8	<2	Low----------	0.17			
	33-60	0.6-6.0	0.13-0.17	6.6-8.4	<2	Low----------	0.17			
Rockoa----------	0-5	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low----------	0.15	5	8	2-4
	5-10	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low----------	0.15			
	10-32	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low----------	0.15			
	32-60	0.6-6.0	0.13-0.17	5.6-7.3	<2	Low----------	0.15			
Rock outcrop.										
MoB-------------- Minnequa	0-4	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low----------	0.32	2	4L	.5-2
	4-24	0.6-2.0	0.16-0.18	7.4-9.0	<4	Low----------	0.32			
	24-60	---	---	---	---	------------	----			
MpE*:										
Minnequa--------	0-4	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low----------	0.32	2	4L	.5-2
	4-24	0.6-2.0	0.16-0.18	7.4-9.0	<4	Low----------	0.32			
	24-60	---	---	---	---	------------	----			
Midway----------	0-4	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate----	0.43	1	4L	.5-2
	4-16	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High--------	0.43			
	16-60	---	---	---	---	------------	----			
MtA, MtB--------- Mitchell	0-11	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low----------	0.43	5	4L	.5-1
	11-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low----------	0.43			
NeD-------------- Nevee	0-8	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low----------	0.32	5	4L	1-3
	8-43	0.6-2.0	0.12-0.20	7.4-9.0	2-4	Low----------	0.43			
	43-60	---	---	---	---	------------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	In/hr	In/in	pH	Mmhos/cm					Pct
NoA, NoB, NoC----- Norka	0-7	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low---------	0.32	5	5	2-4
	7-15	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate----	0.32			
	15-60	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low---------	0.32			
NuA, NuB, NuC----- Nunn	0-8	0.2-2.0	0.15-0.20	6.1-7.8	<2	Moderate----	0.24	5	6	2-4
	8-25	0.06-0.6	0.15-0.18	6.6-8.4	<2	High--------	0.28			
	25-60	0.2-2.0	0.10-0.18	7.4-8.4	<2	Moderate----	0.24			
OrE*:										
Orella-----------	0-2	0.06-0.2	0.09-0.11	7.4-8.4	<4	High--------	0.32	2	4L	.5-1
	2-18	<0.06	0.09-0.11	7.4-9.0	4-16	High--------	0.32			
	18-60	---	---	---	---	------------	----			
Rock outcrop.										
PaD*:										
Paunsaugunt-----	0-8	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low---------	0.20	1	8	1-2
	8-14	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low---------	0.17			
	14-20	---	---	---	---	------------	----			
Boneek-----------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low---------	0.32	5	6	2-4
	7-20	0.2-0.6	0.11-0.17	6.1-7.8	<2	Moderate----	0.43			
	20-41	0.6-2.0	0.16-0.20	7.4-9.0	<4	Low---------	0.43			
	41-60	---	---	---	---	------------	----			
PbF*:										
Paunsaugunt-----	0-8	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low---------	0.20	1	8	1-2
	8-14	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low---------	0.17			
	14-20	---	---	---	---	------------	----			
Vanocker---------	0-3	0.6-2.0	0.10-0.12	7.4-7.8	<2	Moderate----	0.17	3	8	2-4
	3-60	0.6-2.0	0.09-0.11	7.4-7.8	<2	Moderate----	0.24			
Rock outcrop.										
PeB-------------- Pierre	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	20-34	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	34-60	---	---	---	<2	------------	----			
PgE*:										
Pierre-----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	20-34	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	34-60	---	---	---	<2	------------	----			
Grummit----------	0-4	0.2-0.6	0.08-0.12	3.6-5.5	<2	High--------	0.28	2	4	1-2
	4-11	0.6-2.0	0.08-0.12	3.6-5.5	<2	High--------	0.28			
	11-60	---	---	3.6-5.5	---	------------	----			
PsE*:										
Pierre-----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	20-34	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	34-60	---	---	---	<2	------------	----			
Samsil-----------	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-18	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	18-60	---	---	5.6-8.4	---	------------	----			
Pt*, Pu*. Pits										
ReD*:										
Rekop------------	0-4	0.6-2.0	0.16-0.18	7.4-9.0	2-4	Low---------	0.37	1	4L	<.5
	4-15	0.6-2.0	0.12-0.18	7.4-9.0	2-4	Low---------	0.43			
	15-60	---	---	---	---	------------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	Mmhos/cm					Pct
ReD*:										
Tilford----------	0-4	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low-----------	0.32	5	6	2-4
	4-18	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low-----------	0.43			
	18-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low-----------	0.43			
Gystrum----------	0-3	0.6-2.0	0.19-0.21	7.4-8.4	2-4	Moderate------	0.43	2	4L	2-4
	3-28	0.6-2.0	0.19-0.21	7.4-9.0	>2	Moderate------	0.49			
	28-35	---	---	---	---	-------------	----			
RgF*:										
Rock outcrop.										
Gystrum----------	0-3	0.6-2.0	0.19-0.21	7.4-8.4	2-4	Moderate------	0.43	2	4L	2-4
	3-28	0.6-2.0	0.19-0.21	7.4-9.0	>2	Moderate------	0.49			
	28-35	---	---	---	---	-------------	----			
RoF*:										
Rock outcrop.										
Mathias----------	0-2	2.0-6.0	0.11-0.14	6.1-7.8	<2	Low-----------	0.17	5	8	1-2
	2-13	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low-----------	0.17			
	13-33	0.6-2.0	0.14-0.18	6.1-7.8	<2	Low-----------	0.17			
	33-60	0.6-6.0	0.13-0.17	6.6-8.4	<2	Low-----------	0.17			
Butche-----------	0-4	2.0-6.0	0.14-0.17	6.1-7.3	<2	Low-----------	0.24	2	3	1-3
	4-9	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low-----------	0.24			
	9-12	---	---	---	---	-------------	----			
RrF*:										
Rockoa-----------	0-5	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low-----------	0.15	5	8	2-4
	5-10	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low-----------	0.15			
	10-32	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low-----------	0.15			
	32-60	0.6-6.0	0.13-0.17	5.6-7.3	<2	Low-----------	0.15			
Rock outcrop.										
SaE--------------- Samsil	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-18	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	18-60	---	---	5.6-8.4	---	-------------	----			
SbD*:										
Samsil-----------	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-18	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	18-60	---	---	5.6-8.4	---	-------------	----			
Pierre-----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	20-34	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	34-60	---	---	---	<2	-------------	----			
ScA, ScB, ScC---- Satanta	0-8	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-----------	0.28	5	6	2-4
	8-20	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate------	0.28			
	20-60	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low-----------	0.28			
SdA, SdB---------- Savo	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate------	0.32	5	6	2-4
	5-16	0.2-0.6	0.11-0.19	6.1-7.8	<2	High----------	0.43			
	16-42	0.2-0.6	0.11-0.19	7.4-8.4	<2	High----------	0.43			
	42-60	0.2-2.0	0.11-0.17	7.4-8.4	<2	Moderate------	0.43			
SmE*:										
Schamber---------	0-6	>6.0	0.03-0.06	6.1-8.4	<2	Low-----------	0.17	2	6	.5-2
	6-60	>6.0	0.03-0.06	7.4-8.4	<2	Low-----------	0.10			
Eckley-----------	0-4	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low-----------	0.15	5	3	2-3
	4-12	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate------	0.15			
	12-60	>6.0	0.03-0.06	6.6-7.8	<2	Low-----------	0.10			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	In/hr	In/in	pH	Mmhos/cm					Pct
SnE*:										
Shingle----------	0-3	0.6-2.0	0.16-0.18	7.4-9.0	<2	Low----------	0.32	2	4L	<1
	3-17	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate----	0.49			
	17-60	---	---	---	---	------------	----			
Penrose----------	0-13	0.6-2.0	0.15-0.18	7.9-8.4	<2	Low----------	0.24	1	4L	.5-1
	13-37	---	---	---	---	------------	----			
Rock outcrop.										
SpF*:										
Spearfish--------	0-4	0.6-2.0	0.16-0.22	6.6-8.4	<2	Low----------	0.32	2	4L	1-3
	4-17	0.6-2.0	0.12-0.17	7.4-8.4	<4	Low----------	0.32			
	17-60	---	---	---	---	------------	----			
Rock outcrop.										
SsE*:										
Spearfish--------	0-4	0.6-2.0	0.13-0.19	6.6-8.4	<2	Low----------	0.32	2	8	1-3
	4-17	0.6-2.0	0.12-0.17	7.4-8.4	<4	Low----------	0.32			
	17-60	---	---	---	---	------------	----			
Tilford----------	0-4	0.6-2.0	0.16-0.19	6.6-7.8	<2	Low----------	0.32	5	8	2-4
	4-18	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low----------	0.43			
	18-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low----------	0.43			
St---------------- Stetter	0-6	<0.2	0.08-0.16	6.6-8.4	<2	High---------	0.37	5	4	1-3
	6-60	<0.2	0.08-0.16	6.6-8.4	<4	High---------	0.37			
Sw---------------- Swanboy	0-6	<0.06	0.08-0.12	6.6-9.0	<2	Very high	0.37	5	4	1-2
	6-60	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
TaA, TaB, TaC---- Tilford	0-4	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low----------	0.32	5	6	2-4
	4-18	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low----------	0.43			
	18-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low----------	0.43			
TgC*:										
Tilford----------	0-4	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low----------	0.32	5	6	2-4
	4-18	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low----------	0.43			
	18-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low----------	0.43			
Gystrum----------	0-3	0.6-2.0	0.19-0.21	7.4-8.4	2-4	Moderate----	0.43	2	4L	2-4
	3-28	0.6-2.0	0.19-0.21	7.4-9.0	>2	Moderate----	0.49			
	28-60	---	---	---	---	------------	----			
VaE--------------- Valent	0-7	6.0-20	0.07-0.12	6.6-7.8	<2	Low----------	0.10	5	1	.5-1
	7-60	>20	0.03-0.05	6.6-7.8	<2	Low----------	0.10			
WpC*:										
Winler-----------	0-4	<0.06	0.08-0.14	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-7.8	2-4	Very high	0.37			
	20-30	<0.06	0.08-0.12	5.6-8.4	2-4	Very high	0.37			
	30-60	---	---	4.5-7.8	---	------------	----			
Pierre-----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	20-34	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	34-60	---	---	---	<2	------------	----			
ZnE*:										
Zigweid----------	0-6	0.6-2.0	0.16-0.21	7.4-8.4	<2	Moderate----	0.32	5	6	1-3
	6-60	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate----	0.43			
Nihill-----------	0-7	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low----------	0.24	2	5	1-2
	7-60	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low----------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
Aa: Absted	D	None	---	---	>60	---	Low	High	High.
AaC: Alice	B	None	---	---	>60	---	Moderate	Moderate	Low.
AbA, AbB: Altvan	B	None	---	---	>60	---	Moderate	Low	Low.
Ap*. Aquolls									
Ar: Arvada	D	None	---	---	>60	---	Low	High	Moderate.
AsB, AsC: Ascalon	B	None	---	---	>60	---	Moderate	Moderate	Low.
Ba*. Badland									
Bb: Bankard	A	Occasional	Brief	Mar-Jun	>60	---	Low	Moderate	Low.
Bc: Barnum	B	Occasional	Brief	May-Jul	>60	---	Low	High	High.
BoA, BoB: Boneek	B	None	---	---	>60	---	Low	High	Low.
BpB: Boneek	B	None	---	---	40-60	Soft	Low	High	Low.
BrD: Broadhurst	D	None	---	---	>60	---	Low	High	High.
BuB: Bufton	C	None	---	---	>60	---	Low	High	Low.
BvD*:									
Butche	D	None	---	---	7-20	Hard	Low	Moderate	Low.
Boneek	B	None	---	---	40-60	Soft	Low	High	Low.
CnD*:									
Colby	B	None	---	---	>60	---	Low	Low	Low.
Norka	B	None	---	---	>60	---	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					In				
DaB, DaC: Dailey	A	None	---	---	>60	---	Low	High	Low.
DwA, DwB, DwE: Dwyer	A	None	---	---	>60	---	Low	High	Low.
EaC: Eckley	B	None	---	---	>60	---	Low	Moderate	Low.
Ga: Glenberg	B	Rare	---	---	>60	---	Low	High	Low.
GrE*:									
Grummit	D	None	---	---	10-20	Soft	Low	High	High.
Rock outcrop.									
GsD*:									
Grummit	D	None	---	---	10-20	Soft	Low	High	High.
Snomo	C	None	---	---	>60	---	Low	Moderate	High.
Ha: Haverson	B	Rare	---	---	>60	---	Low	High	Low.
HbB: Haverson Variant	B	Rare	---	---	>60	---	Moderate	High	Low.
He*:									
Hisle	D	None	---	---	20-40	Soft	Low	High	Moderate.
Slickspots.									
Ho: Hoven	D	None	---	---	>60	---	Moderate	High	Moderate.
JaB: Jayem	B	None	---	---	>60	---	Low	High	Low.
KaB: Kadoka	B	None	---	---	20-40	Soft	Moderate	Moderate	Low.
KeD*:									
Kadoka	B	None	---	---	20-40	Soft	Moderate	Moderate	Low.
Epping	D	None	---	---	10-20	Soft	Low	High	Low.
KyA, KyB: Kyle	D	None	---	---	>60	---	Low	High	Moderate.
Lo: Lohmiller	C	Rare	---	---	>60	---	Low	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
MaA----------------- Manvel	C	None---------	---	---	>60	---	Low-------------	High------	Moderate.
MbA, MbB----------- Manzanola	C	None---------	---	---	>60	---	Low-------------	High------	Moderate.
MmE*:									
Mathias-----------	B	None---------	---	---	>60	---	Moderate--------	High------	Low.
Midway------------	D	None---------	---	---	6-20	Soft	Low-------------	High------	High.
Rock outcrop.									
MnF*:									
Mathias-----------	B	None---------	---	---	>60	---	Moderate--------	High------	Low.
Rockoa------------	B	None---------	---	---	>60	---	Moderate--------	High------	Moderate.
Rock outcrop.									
MoB----------------- Minnequa	B	None---------	---	---	20-40	Soft	Low-------------	High------	Moderate.
MpE*:									
Minnequa----------	B	None---------	---	---	20-40	Soft	Low-------------	High------	Moderate.
Midway------------	D	None---------	---	---	6-20	Soft	Low-------------	High------	High.
MtA, MtB----------- Mitchell	B	None---------	---	---	>60	---	Low-------------	High------	Low.
NeD----------------- Nevee	B	None---------	---	---	40-60	Soft	Low-------------	High------	Moderate.
NoA, NoB, NoC------ Norka	B	None---------	---	---	>60	---	Moderate--------	Moderate	Low.
NuA, NuB, NuC------ Nunn	C	None---------	---	---	>60	---	Moderate--------	High------	Low.
OrE*:									
Orella------------	D	None---------	---	---	10-20	Soft	Low-------------	High------	Low.
Rock outcrop.									
PaD*:									
Paunsaugunt-------	D	None---------	---	---	10-20	Hard	Moderate--------	High------	Moderate.
Boneek------------	B	None---------	---	---	40-60	Soft	Low-------------	High------	Low.
PbF*:									
Paunsaugunt-------	D	None---------	---	---	10-20	Hard	Moderate--------	High------	Moderate.
Vanocker----------	C	None---------	---	---	>60	---	Moderate--------	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
PbF*:									
Rock outcrop.									
PeB----------------- Pierre	D	None---------	---	---	20-40	Soft	Low------------	High------	Moderate.
PgE*:									
Pierre------------	D	None---------	---	---	20-40	Soft	Low------------	High------	Moderate.
Grummit-----------	D	None---------	---	---	10-20	Soft	Low------------	High------	High.
PsE*:									
Pierre------------	D	None---------	---	---	20-40	Soft	Low------------	High------	Moderate.
Samsil------------	D	None---------	---	---	4-20	Soft	Low------------	High------	Moderate.
Pt*, Pu*. Pits									
ReD*:									
Rekop-------------	D	None---------	---	---	6-20	Soft	Low------------	High------	High.
Tilford-----------	B	None---------	---	---	>60	---	Moderate--------	Moderate	Low.
Gystrum-----------	C	None---------	---	---	20-40	Soft	Low------------	High------	High.
RgF*:									
Rock outcrop.									
Gystrum-----------	C	None---------	---	---	20-40	Soft	Low------------	High------	High.
RoF*:									
Rock outcrop.									
Mathias-----------	B	None---------	---	---	>60	---	Moderate--------	High------	Low.
Butche------------	D	None---------	---	---	7-20	Hard	Low------------	Moderate	Low.
RrF*:									
Rockoa------------	B	None---------	---	---	>60	---	Moderate--------	High------	Moderate.
Rock outcrop.									
SaE----------------- Samsil	D	None---------	---	---	4-20	Soft	Low------------	High------	Moderate.
SbD*:									
Samsil------------	D	None---------	---	---	4-20	Soft	Low------------	High------	Moderate.
Pierre------------	D	None---------	---	---	20-40	Soft	Low------------	High------	Moderate.
ScA, ScB, ScC------ Satanta	B	None---------	---	---	>60	---	Moderate--------	Low-------	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
SdA, SdB: Savo	C	None	---	---	>60	---	Low	High	Moderate.
SmE*:									
Schamber	A	None	---	---	>60	---	Low	Moderate	Low.
Eckley	B	None	---	---	>60	---	Low	Moderate	Low.
SnE*:									
Shingle	D	None	---	---	4-20	Soft	Low	High	Low.
Penrose	D	None	---	---	10-20	Soft	Low	High	Low.
Rock outcrop.									
SpF*:									
Spearfish	D	None	---	---	6-20	Soft	Low	High	High.
Rock outcrop.									
SsE*:									
Spearfish	D	None	---	---	6-20	Soft	Low	High	High.
Tilford	B	None	---	---	>60	---	Moderate	Moderate	Low.
St: Stetter	D	Occasional	Brief	Mar-Oct	>60	---	Low	High	Low.
Sw: Swanboy	D	None	---	---	>60	---	Low	High	High.
TaA, TaB, TaC: Tilford	B	None	---	---	>60	---	Moderate	Moderate	Low.
TgC*:									
Tilford	B	None	---	---	>60	---	Moderate	Moderate	Low.
Gystrum	C	None	---	---	20-40	Soft	Low	High	High.
VaE: Valent	A	None	---	---	>60	---	Low	Low	Low.
WpC*:									
Winler	D	None	---	---	20-40	Soft	Low	High	High.
Pierre	D	None	---	---	20-40	Soft	Low	High	Moderate.
ZnE*:									
Zigweid	B	None	---	---	>60	---	Low	High	Low.
Nihill	B	None	---	---	>60	---	Moderate	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture
											Pct		Lb/Ft3	Pct
Bankard fine sandy loam: (S75SD-047-003)														
C-------- 5 to 60	A-2-4(00)	SM	100	100	99	64	22	--	6	--	19	NP	120	12
Butche fine sandy loam: (S75SD-047-007)														
C-------- 5 to 15	A-4(05)	ML	100	90	81	80	62	--	39	--	36	10	107	18
Colby silt loam: (S74SD-047-001)														
A1------- 0 to 4	A-6(12)	ML	100	100	99	97	90	--	32	--	38	12	97	23
C-------- 7 to 60	A-6(11)	CL	100	99	98	92	84	--	32	--	37	13	106	19
Dailey fine sand: (S75SD-047-006)														
A1------- 4 to 14	A-2-4(00)	SM	100	100	100	83	16	--	6	--	17	NP	119	13
C---------20 to 60	A-2-4(00)	SM	100	100	100	84	19	--	6	--	19	NP	113	15
Savo silt loam: (S75SD-047-001)														
B2t------ 7 to 16	A-7-6(22)	CL	100	100	100	100	96	--	46	--	46	20	96	24
C---------25 to 60	A-6(12)	CL	100	100	100	99	92	--	36	--	35	12	108	18
Valent loamy fine sand: (S75SD-047-002)														
C---------10 to 60	A-3(01)	SP-SM	100	100	100	90	7	--	4	--	18	NP	105	5

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Absted	Fine, montmorillonitic, mesic Haplustollic Natrargids
Alice	Coarse-loamy, mixed, mesic Aridic Haplustolls
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Aquolls	Mixed, mesic Haplaquolls
Arvada	Fine, montmorillonitic, mesic Ustollic Natrargids
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Barnum	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Boneek	Fine, montmorillonitic, mesic Aridic Argiustolls
Broadhurst	Very-fine, montmorillonitic, acid, mesic Ustertic Torriorthents
Bufton	Fine, mixed, mesic Ustollic Camborthids
Butche	Loamy, mixed, nonacid, mesic Lithic Ustic Torriorthents
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
Dwyer	Mixed, mesic Ustic Torripsamments
Eckley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Epping	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Grummit	Clayey, montmorillonitic, acid, mesic, shallow Ustic Torriorthents
Gystrum	Fine-silty, gypsic, mesic Ustollic Camborthids
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Haverson Variant	Loamy-skeletal, mixed (calcareous), mesic Ustic Torrifluvents
Hisle	Fine, montmorillonitic, mesic Ustollic Natrargids
Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Kadoka	Fine-silty, mixed, mesic Aridic Argiustolls
Kyle	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Lohmiller	Fine, montmorillonitic (calcareous), mesic Ustic Torrifluvents
Manvel	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Manzanola	Fine, montmorillonitic, mesic Ustollic Haplargids
Mathias	Loamy-skeletal, mixed, mesic Typic Haplustalfs
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Minnequa	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Mitchell	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Nevee	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Norka	Fine-silty, mixed, mesic Aridic Argiustolls
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Orella	Clayey, mixed (calcareous), mesic, shallow Ustic Torriorthents
Paunsaugunt	Loamy-skeletal, mixed Lithic Haploborolls
Penrose	Loamy, mixed (calcareous), mesic Lithic Ustic Torriorthents
Pierre	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Rekop	Loamy, gypsic, mesic, shallow Ustic Torriorthents
Rockoa	Loamy-skeletal, mixed Typic Eutroboralfs
Samsil	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Savo	Fine, montmorillonitic, mesic Aridic Argiustolls
Schamber	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Shingle	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Snomo	Very-fine, montmorillonitic, mesic Ustollic Camborthids
Spearfish	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Stetter	Fine, montmorillonitic, nonacid, mesic Ustertic Torrifluvents
Swanboy	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Tilford	Fine-silty, mixed, mesic Torriorthentic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
*Vanocker	Loamy-skeletal, mixed, frigid Typic Eutrochrepts
Winler	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Zigweid	Fine-loamy, mixed, mesic Ustollic Camborthids

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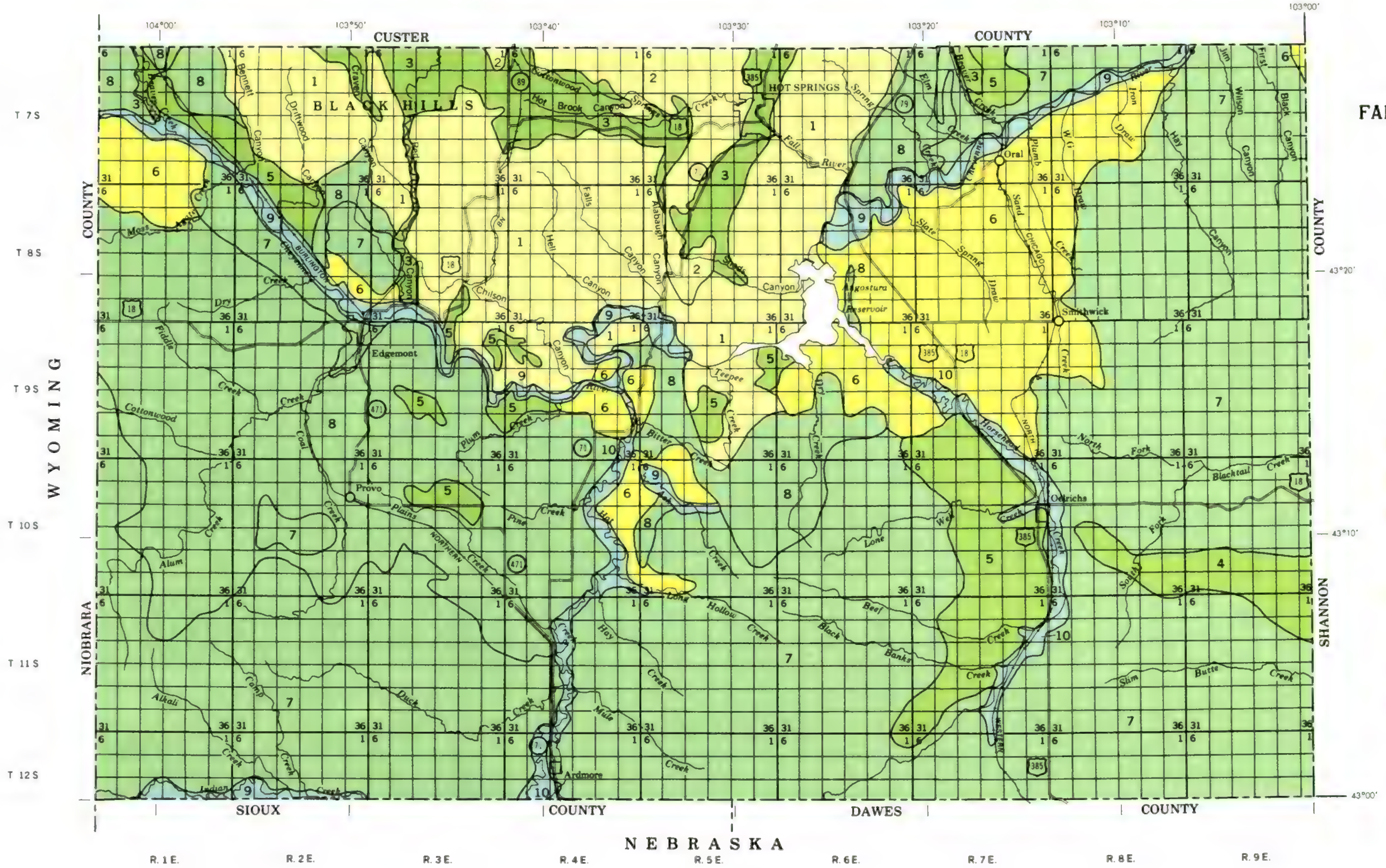
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE AND FOREST SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

FALL RIVER COUNTY, SOUTH DAKOTA

Scale 1: 316,800



SOIL LEGEND*

GENTLY SLOPING TO VERY STEEP, STONY AND LOAMY SOILS ON MOUNTAINS AND UPLANDS IN THE BLACK HILLS

1 — Mathias-Butche-Rockoa association: Deep and shallow, well drained, gently sloping to very steep, stony and loamy soils on mountains and uplands

2 — Paunsaugunt-Vanocker association: Shallow and deep, well drained, strongly sloping to very steep, loamy soils on mountains

NEARLY LEVEL TO STEEP, SILTY, LOAMY, AND CLAYEY SOILS ON UPLANDS

3 — Tilford-Spearfish association: Deep and shallow, well drained, nearly level to steep, silty and loamy soils on uplands

4 — Kadoka-Orella-Bufton association: Moderately deep, shallow, and deep, well drained, nearly level to steep, silty and clayey soils on uplands

5 — Norka association: Deep, well drained, nearly level to moderately sloping, silty soils on uplands

NEARLY LEVEL TO STRONGLY SLOPING, SANDY AND LOAMY SOILS ON UPLANDS

6 — Dailey-Ascalon association: Deep, somewhat excessively drained and well drained, nearly level to strongly sloping, sandy and loamy soils on uplands

GENTLY SLOPING TO STEEP, CLAYEY AND SILTY SOILS ON UPLANDS

7 — Pierre-Samsil association: Moderately deep and shallow, well drained, gently sloping to steep, clayey soils on uplands

8 — Minnequa-Grummit association: Moderately deep and shallow, well drained, gently sloping to steep, silty and clayey soils on uplands

NEARLY LEVEL, LOAMY AND SILTY SOILS ON FLOOD PLAINS

9 — Glenberg-Bankard association: Deep, well drained and somewhat excessively drained, nearly level, loamy soils on flood plains

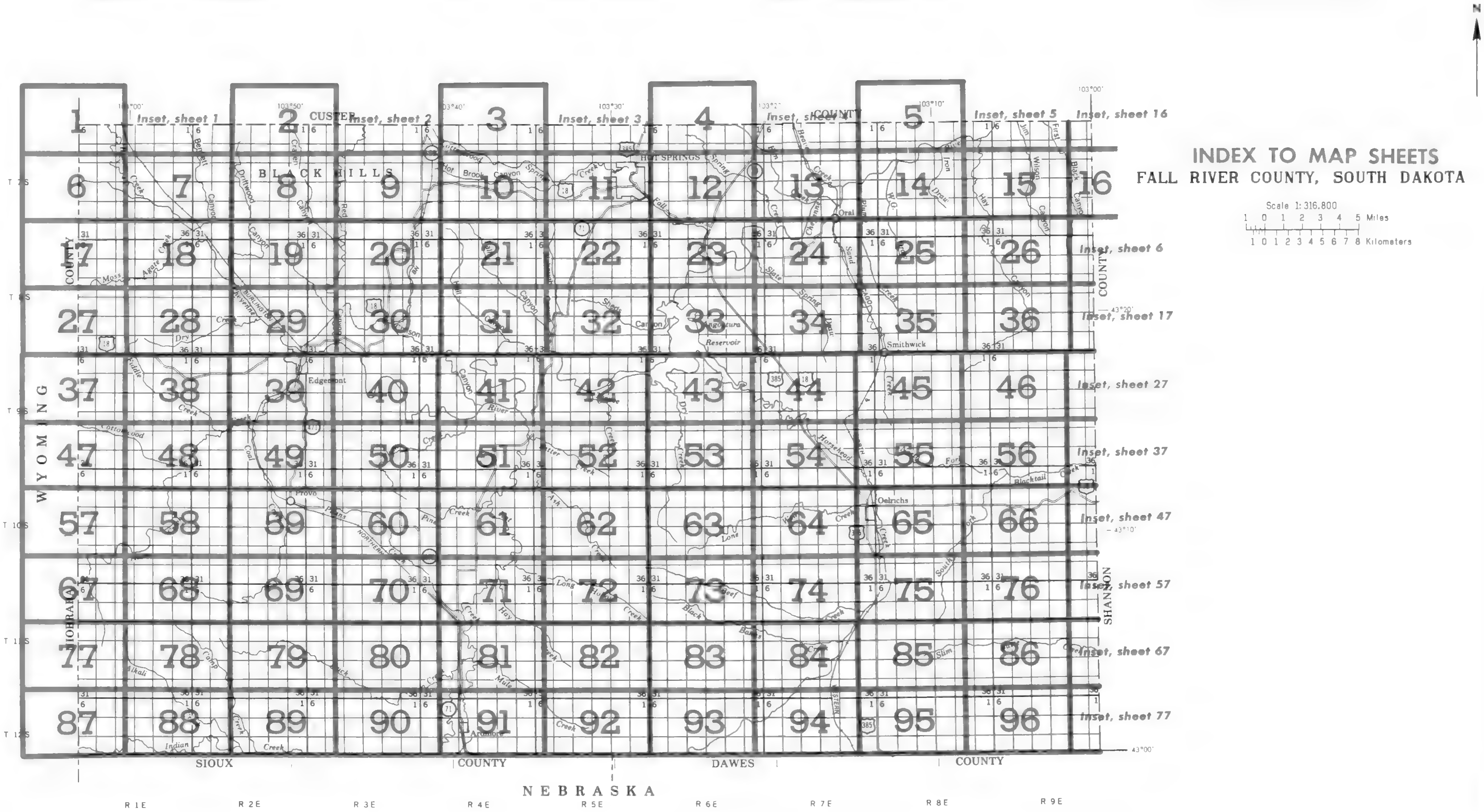
10 — Lohmiller-Haverson association: Deep, well drained, nearly level, silty and loamy soils on flood plains

*The texture terms in the descriptive headings refer to the surface layer of the major soils in each association.

Compiled 1981

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



Original text from each individual map sheet read:
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- cemetery

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Trail

ROAD EMBLEMS & DESIGNATIONS

- Federal — 410
- State — 52

RAILROAD

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School

WATER FEATURES

DRAINAGE

- Perennial, double line
- Intermittent
- Drainage end

LAKES, PONDS AND RESERVOIRS

- Perennial

MISCELLANEOUS WATER FEATURES

- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — PeB MmE

MISCELLANEOUS

- Blowout
- Prominent hill or peak

SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The second capital letter indicates the slope class. Symbols without a slope letter are for nearly level soils or miscellaneous areas. The miscellaneous areas may have a considerable range of slope

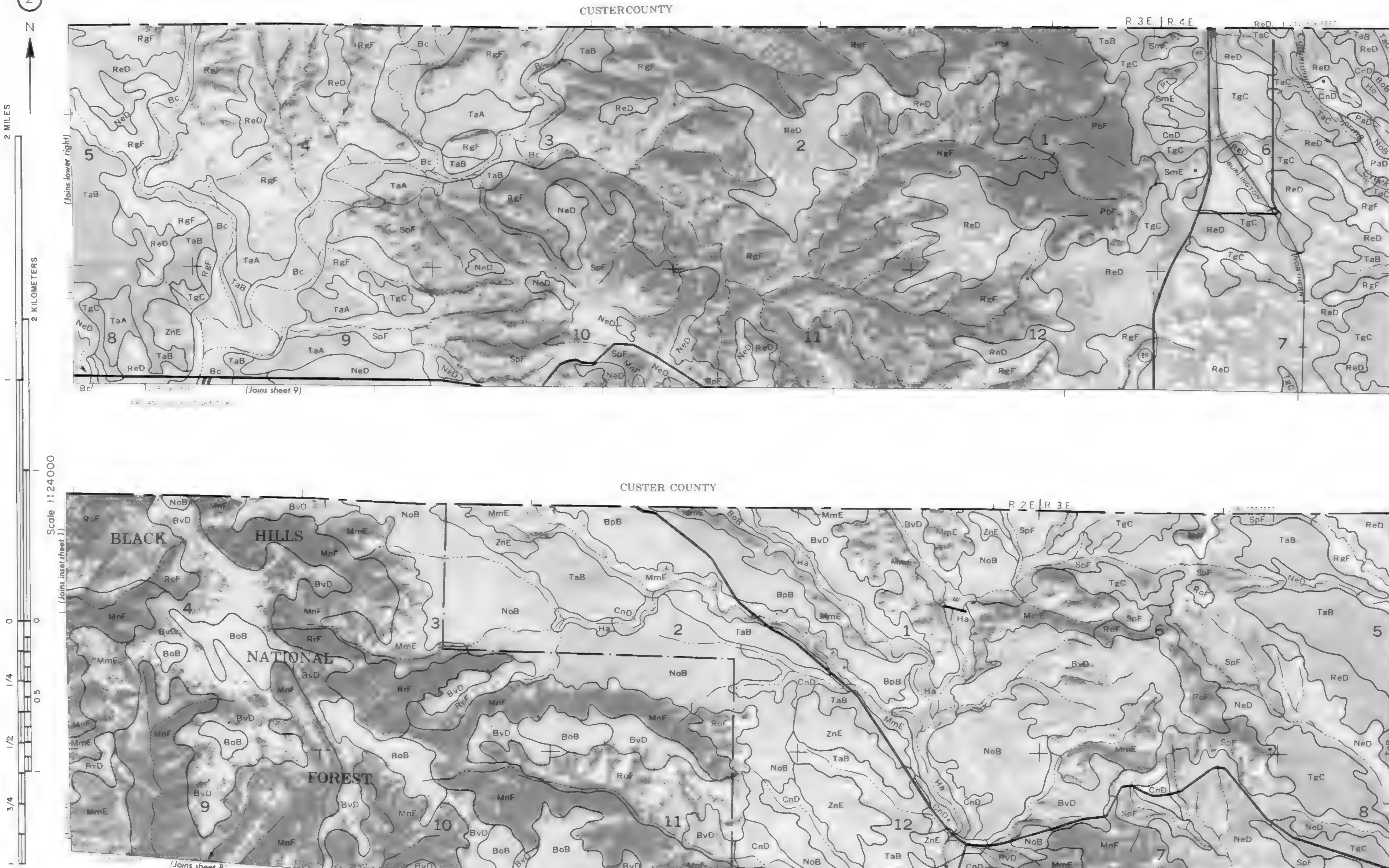
SYMBOL	NAME	SYMBOL	NAME
Aa	Absted silt loam	MpE	Minnequa-Midway silty clay loams, 6 to 25 percent slopes
AaC	Alice fine sandy loam, 2 to 9 percent slopes	MtA	Mitchell very fine sandy loam, 0 to 2 percent slopes
AbA	Altvan loam, 0 to 2 percent slopes	MtB	Mitchell very fine sandy loam, 2 to 6 percent slopes
AbB	Altvan loam, 2 to 6 percent slopes	NeD	Nevee silt loam, 6 to 15 percent slopes
Ap	Aquolls, nearly level	NoA	Norka silt loam, 0 to 2 percent slopes
Ar	Arvada loam	NoB	Norka silt loam, 2 to 6 percent slopes
AsB	Ascalon fine sandy loam, 0 to 6 percent slopes	NoC	Norka silt loam, 6 to 9 percent slopes
AsC	Ascalon fine sandy loam, 6 to 9 percent slopes	NuA	Nunn clay loam, 0 to 2 percent slopes
Ba	Badland	NuB	Nunn clay loam, 2 to 6 percent slopes
Bb	Bankard fine sandy loam	NuC	Nunn clay loam, 6 to 9 percent slopes
Bc	Barnum silt loam	OrE	Orella-Rock outcrop complex, 6 to 40 percent slopes
BoA	Boneek silt loam, 0 to 2 percent slopes	PaD	Paunsaugunt-Boneek complex, 6 to 15 percent slopes
BoB	Boneek silt loam, 2 to 6 percent slopes	PbF	Paunsaugunt-Vanocker-Rock outcrop complex, 9 to 60 percent slopes
BpB	Boneek silt loam, bedrock substratum, 2 to 6 percent slopes	PeB	Pierre clay, 2 to 6 percent slopes
BrD	Broadhurst clay, 2 to 15 percent slopes	PgE	Pierre-Grummit clays, 6 to 25 percent slopes
BuB	Bufton silty clay loam, 2 to 6 percent slopes	PsE	Pierre-Samsil clays, 6 to 25 percent slopes
BvD	Butche-Boneek complex, 3 to 15 percent slopes	Pt	Pits, gravel
CnD	Colby-Norka silt loams, 6 to 15 percent slopes	Pu	Pits, mine
DaB	Dailey fine sand, 0 to 6 percent slopes	ReD	Rekop-Tilford-Gystrum complex, 6 to 15 percent slopes
DaC	Dailey fine sand, 6 to 12 percent slopes	RgF	Rock outcrop-Gystrum complex, 9 to 50 percent slopes
DwA	Dwyer loamy fine sand, 0 to 2 percent slopes	RoF	Rock outcrop-Mathias-Butche complex, 30 to 75 percent slopes
DwB	Dwyer loamy fine sand, 2 to 6 percent slopes	RrF	Rockoa-Rock outcrop complex, 25 to 60 percent slopes
DwE	Dwyer loamy fine sand, 6 to 25 percent slopes	SaE	Samsil clay, 15 to 40 percent slopes
EaC	Eckley loam, 0 to 9 percent slopes	SbD	Samsil-Pierre clays, 6 to 15 percent slopes
Ga	Glenberg fine sandy loam	ScA	Satanta loam, 0 to 2 percent slopes
GrE	Grummit-Rock outcrop complex, 3 to 40 percent slopes	ScB	Satanta loam, 2 to 6 percent slopes
GsD	Grummit-Snomo clays, 3 to 15 percent slopes	ScC	Satanta loam, 6 to 9 percent slopes
Ha	Haverson loam	SdA	Savo silt loam, 0 to 2 percent slopes
HbB	Haverson Variant loam, 3 to 9 percent slopes	SdB	Savo silt loam, 2 to 6 percent slopes
He	Hisle-Slickspots complex	SmE	Schamber-Eckley complex, 9 to 40 percent slopes
Ho	Hoven silt loam	SnE	Shingle-Penrose-Rock outcrop complex, 15 to 40 percent slopes
JaB	Jayem fine sandy loam, 2 to 9 percent slopes	SpF	Spearfish-Rock outcrop complex, 9 to 50 percent slopes
KaB	Kadoka silt loam, 0 to 6 percent slopes	SsE	Spearfish-Tilford extremely stony loams, 6 to 25 percent slopes
KeD	Kadoka-Epping silt loams, 6 to 15 percent slopes	St	Stetter clay
KyA	Kyle clay, 0 to 2 percent slopes	Sw	Swanboy clay
KyB	Kyle clay, 2 to 6 percent slopes	TaA	Tilford silt loam, 0 to 2 percent slopes
Lo	Lohmiller silty clay loam	TaB	Tilford silt loam, 2 to 6 percent slopes
MaA	Manvel silt loam, 0 to 2 percent slopes	TaC	Tilford silt loam, 6 to 9 percent slopes
MbA	Manzanola silty clay loam, 0 to 2 percent slopes	TgC	Tilford-Gystrum complex, 2 to 9 percent slopes
MbB	Manzanola silty clay loam, 2 to 6 percent slopes	VaE	Valent loamy fine sand, 6 to 25 percent slopes
MmE	Mathias-Midway-Rock outcrop complex, 15 to 30 percent slopes	WpC	Winler-Pierre clays, 2 to 9 percent slopes
MnF	Mathias-Rockoa-Rock outcrop complex, 25 to 60 percent slopes	ZnE	Zigweid-Nihill complex, 6 to 20 percent slopes
MoB	Minnequa silt loam, 2 to 6 percent slopes		

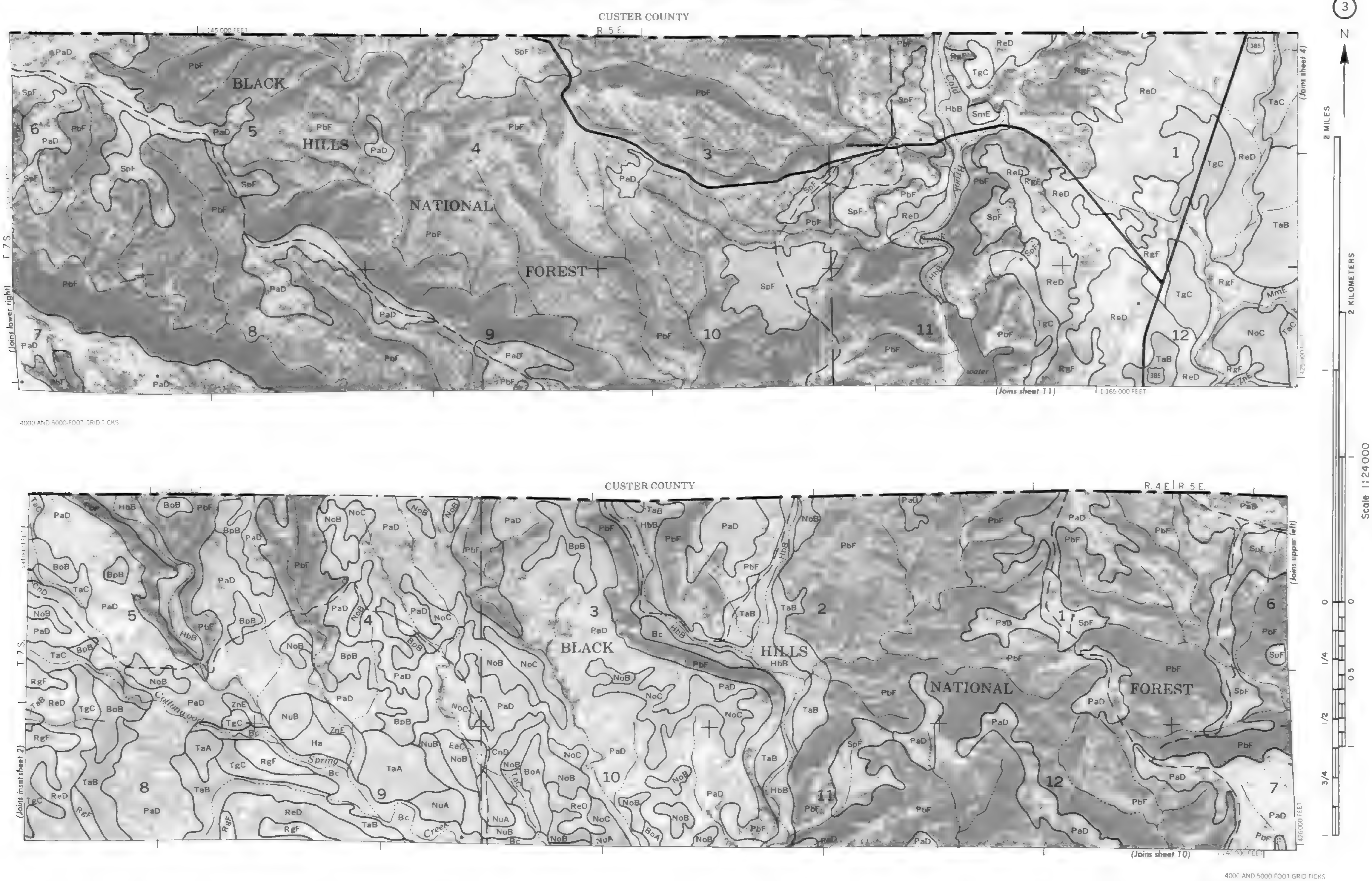
FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 1

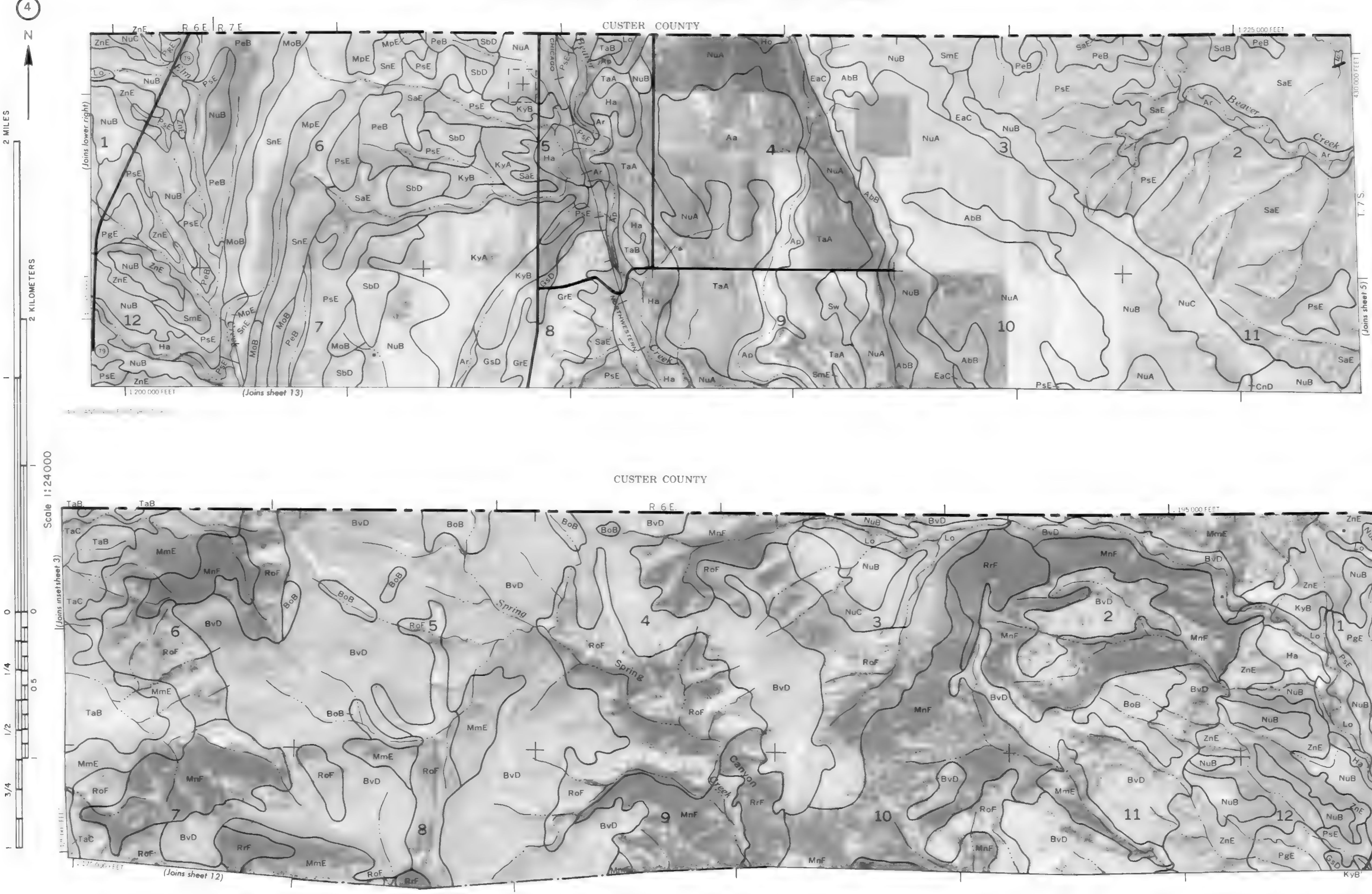
1

2

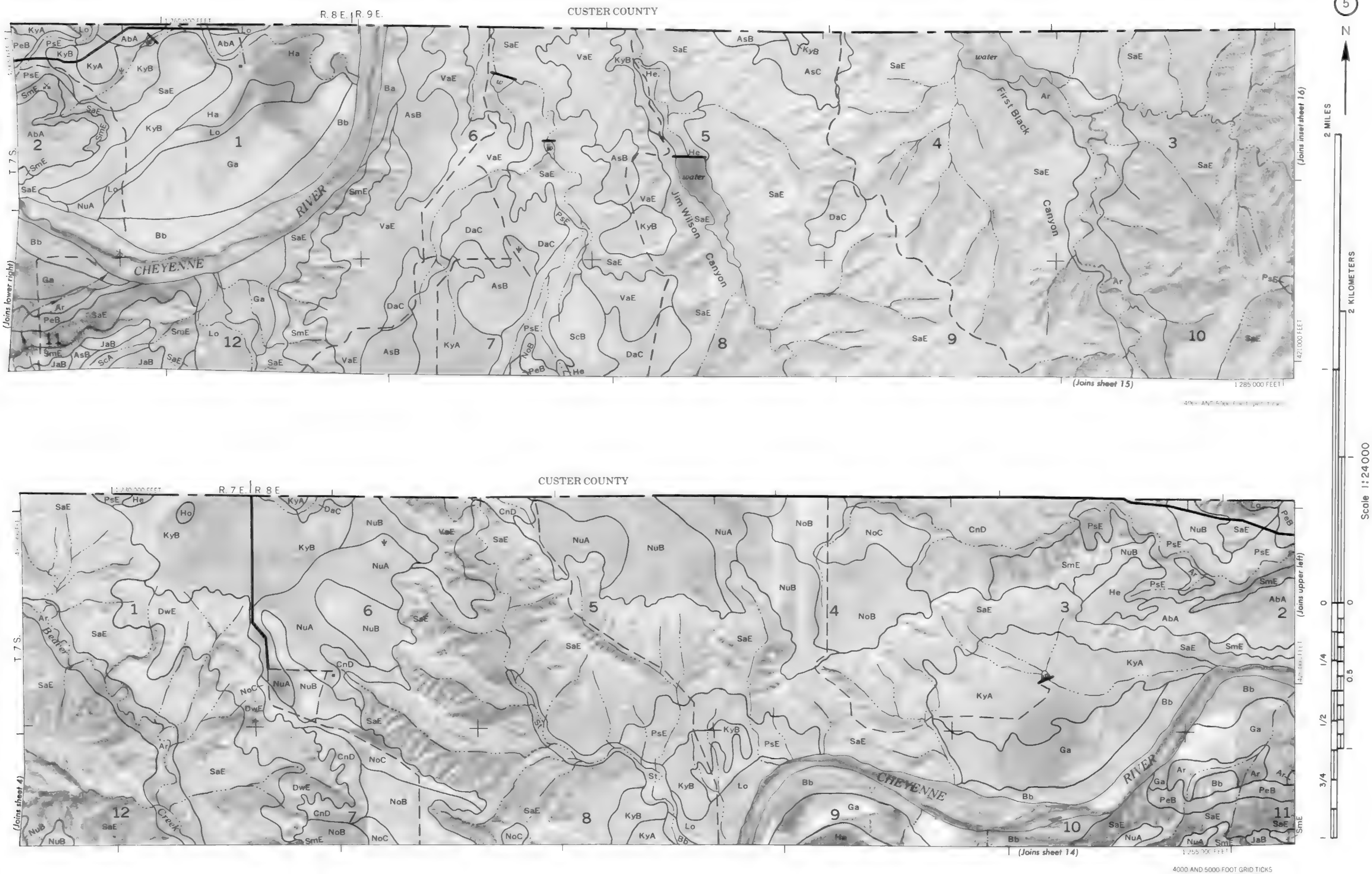
FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 2

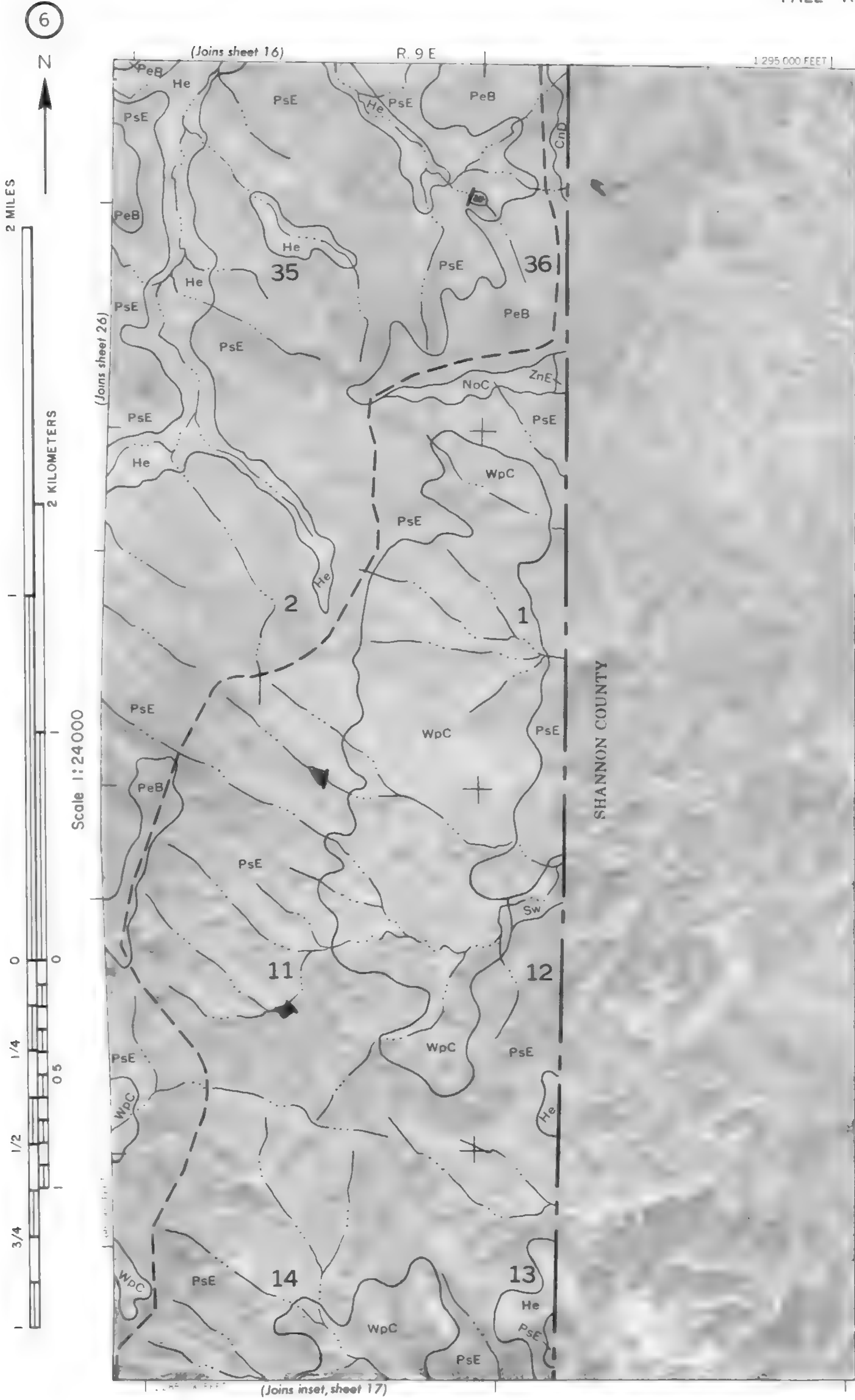


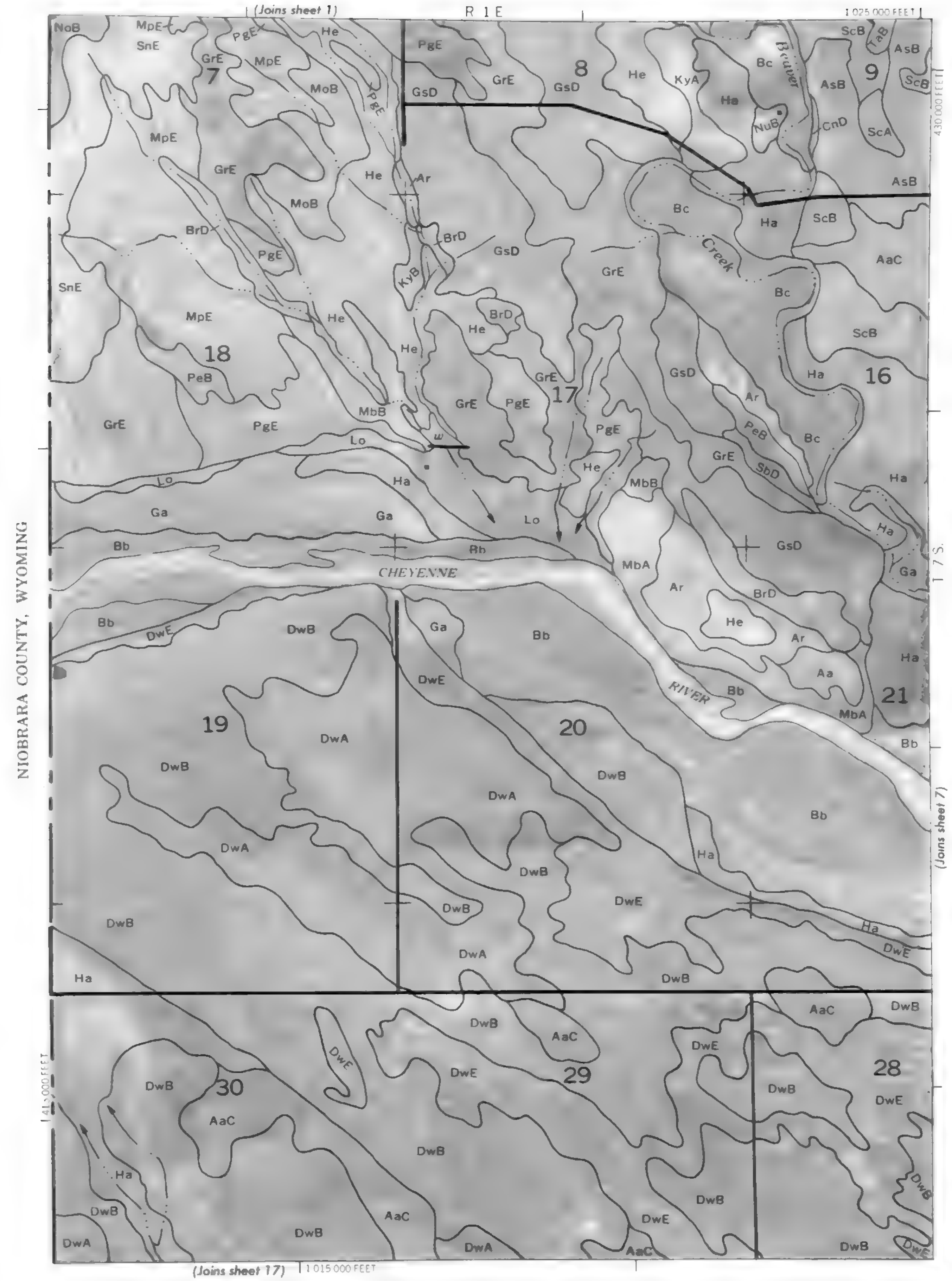

3
CUSTER COUNTY
R. 5 E.
BLACK HILLS NATIONAL FOREST
T. 7 S.
(Joins lower right)
(Joins sheet 4)
(Joins sheet 11)
1 165 000 FEET
4000 AND 5000-FOOT GRID TICKS
Cold
Brush
Creek
water
385
CUSTER COUNTY
R. 4 E. | R. 5 E.
BLACK HILLS NATIONAL FOREST
T. 7 S.
(Joins inset sheet 2)
(Joins upper left)
(Joins sheet 10)
Cottonwood
Spring
Creek
426 000 FEET
4000 AND 5000 FOOT GRID TICKS
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5

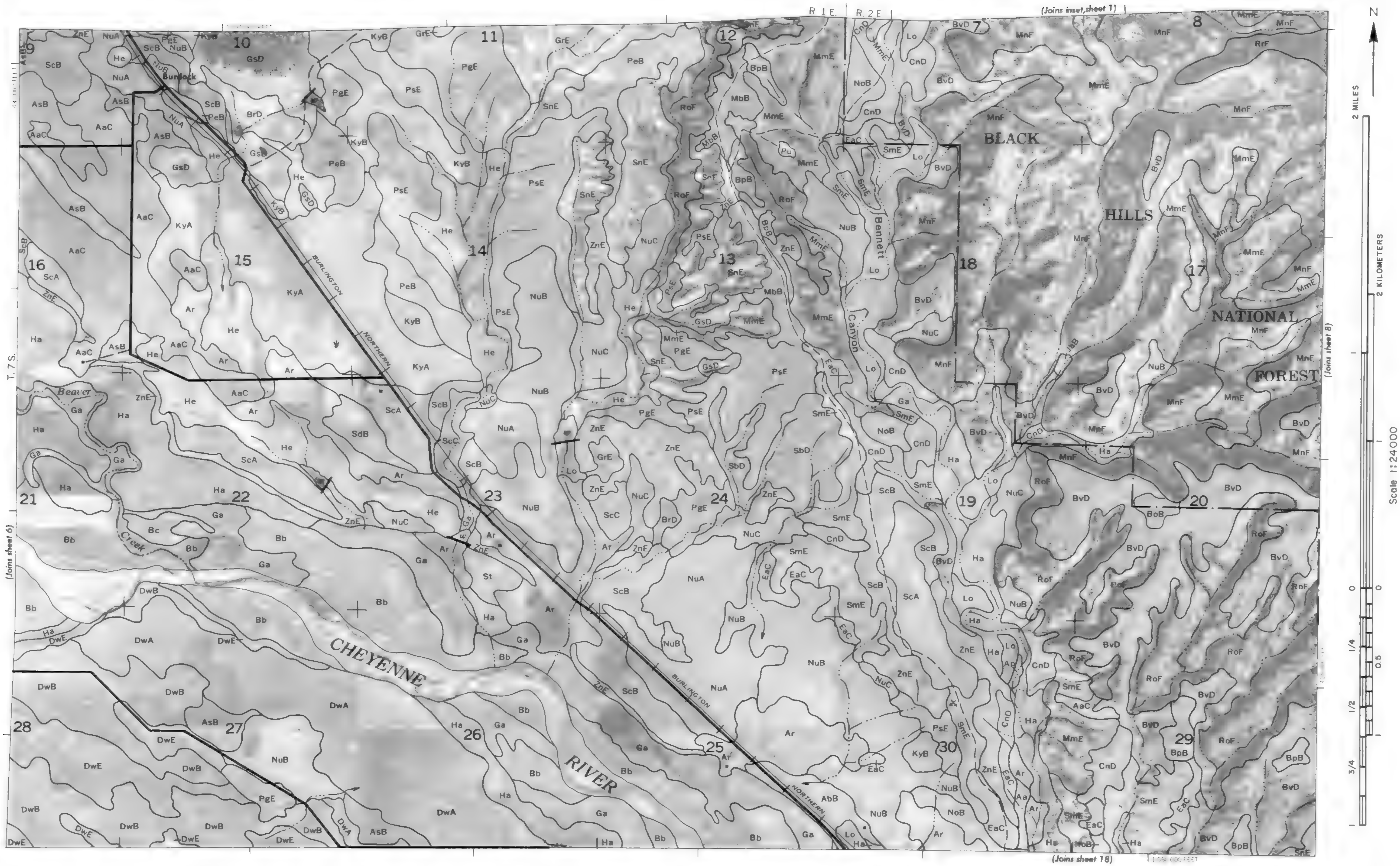

4
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5
CUSTER COUNTY
R 6 E
R 7 E
T 7 S.
(Joins lower right)
(Joins sheet 13)
(Joins sheet 5)
1 225 000 FEET
1 200 000 FEET
430 000 FEET
Beaver Creek
Elm Creek
CHICAGO
NORTHWESTERN
CUSTER COUNTY
R 6 E
1 195 000 FEET
(Joins inset sheet 3)
(Joins sheet 12)
(Joins upper left)
Spring
Canyon Creek
T 7 S.

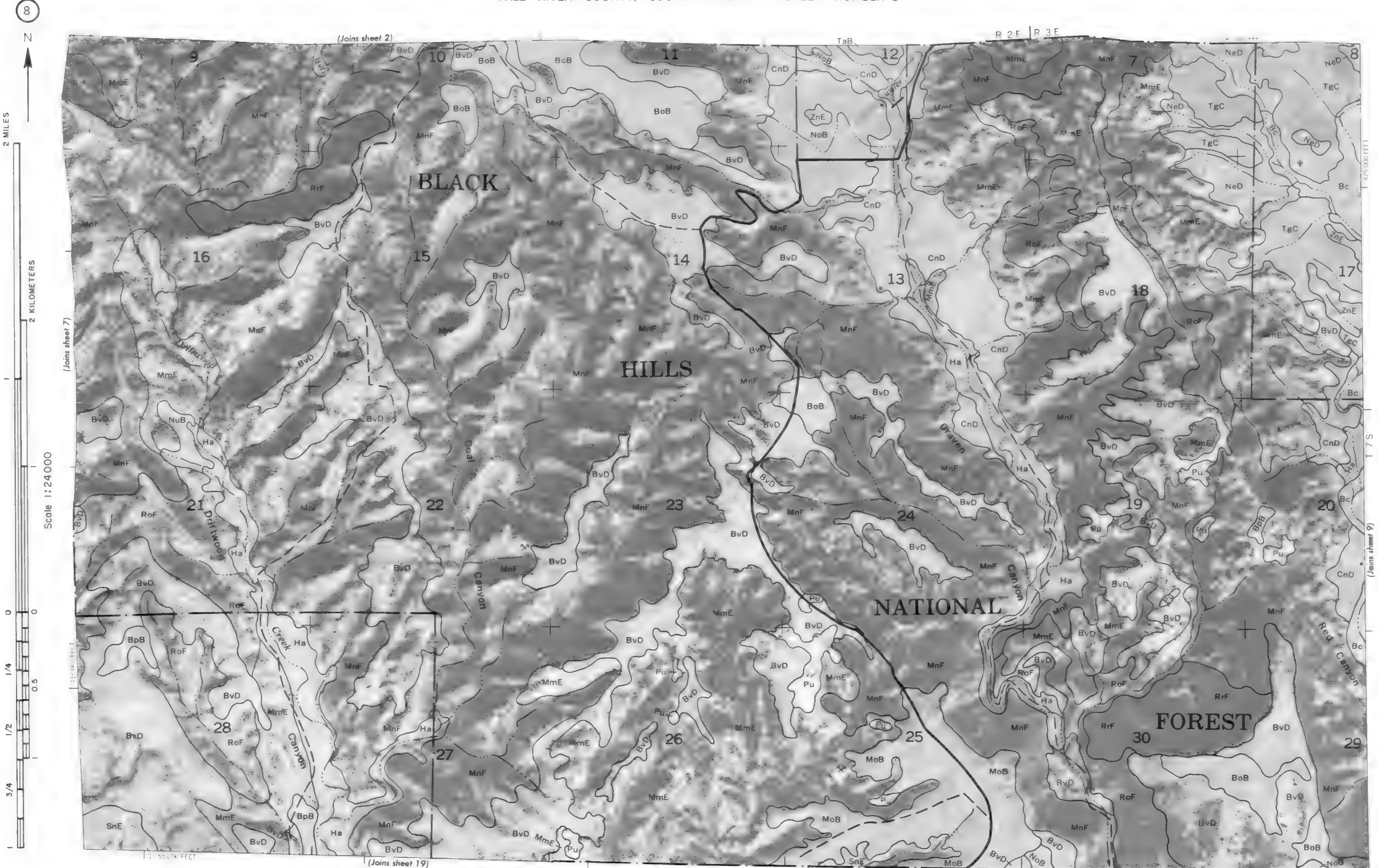
FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 5




6
N
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
0.5
(Joins sheet 16)
R. 9 E.
1 295 000 FEET
(Joins sheet 26)
T. 7 S.
T. 8 S.
SHANNON COUNTY
(Joins inset, sheet 17)
35
36
2
1
11
12
14
13
PeB
He
PsE
CnD
NoC
ZnE
WpC
Sw

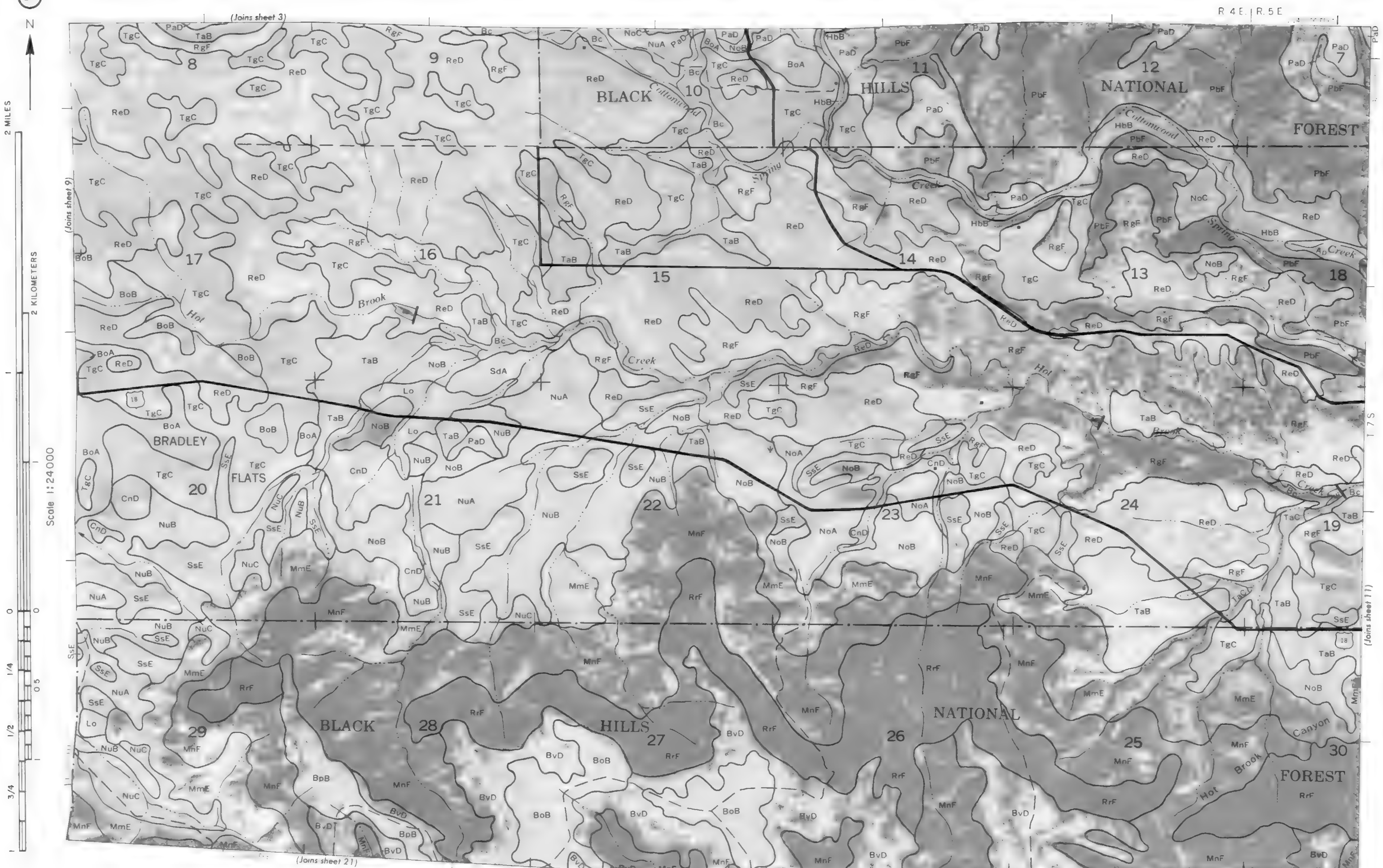

(Joins sheet 1)
R. 1 E.
1 025 000 FEET
430 000 FEET
NIOBRARA COUNTY, WYOMING
(Joins sheet 7)
(Joins sheet 17)
1 015 000 FEET
410 000 FEET
T. 7 S.
CHEYENNE
RIVER
Beaver
Creek
7
8
9
16
17
18
19
20
21
28
29
30
NoB
MpE
SnE
GrE
PgE
He
MoB
GsD
KyA
Ha
Bc
NuB
AsB
ScB
ScA
TaB
CnD
Ar
BrD
KyB
MbB
Lo
Ga
Bb
DwE
DwB
DwA
MbA
SbD
PeB
Aa
AaC
AsB

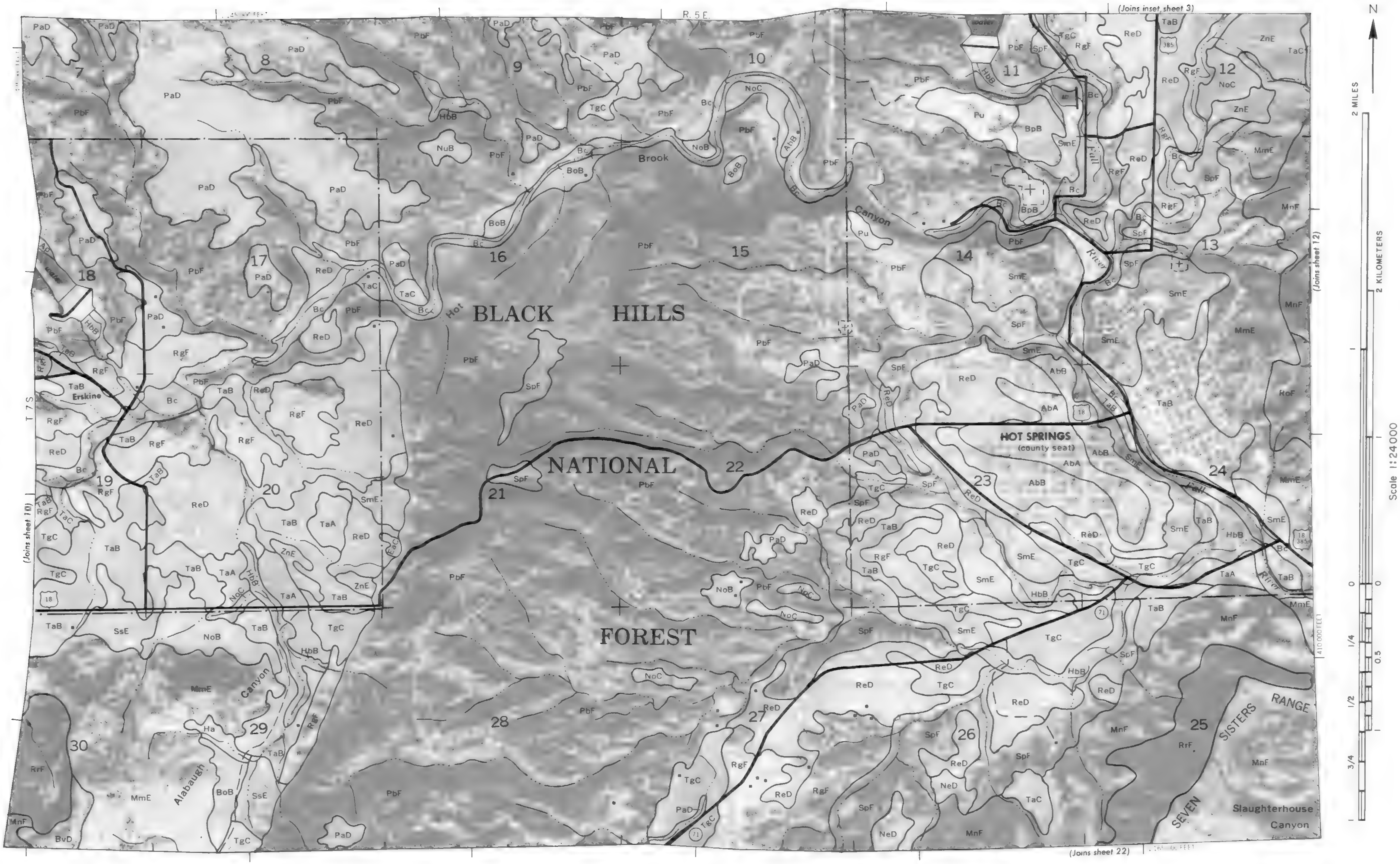

7
N
(Joins inset, sheet 1)
(Joins sheet 8)
(Joins sheet 6)
(Joins sheet 18)
R. 1 E.
R. 2 E.
T. 7 S.
BLACK
HILLS
NATIONAL
FOREST
CHEYENNE
RIVER
Beaver
Creek
Bennett
Canyon
Burdock
BURLINGTON
NORTHERN
2 MILES
2 KILOMETERS
Scale 1:24000
9
10
11
12
7
8
16
15
14
13
18
17
21
22
23
24
19
20
28
27
26
25
30
29

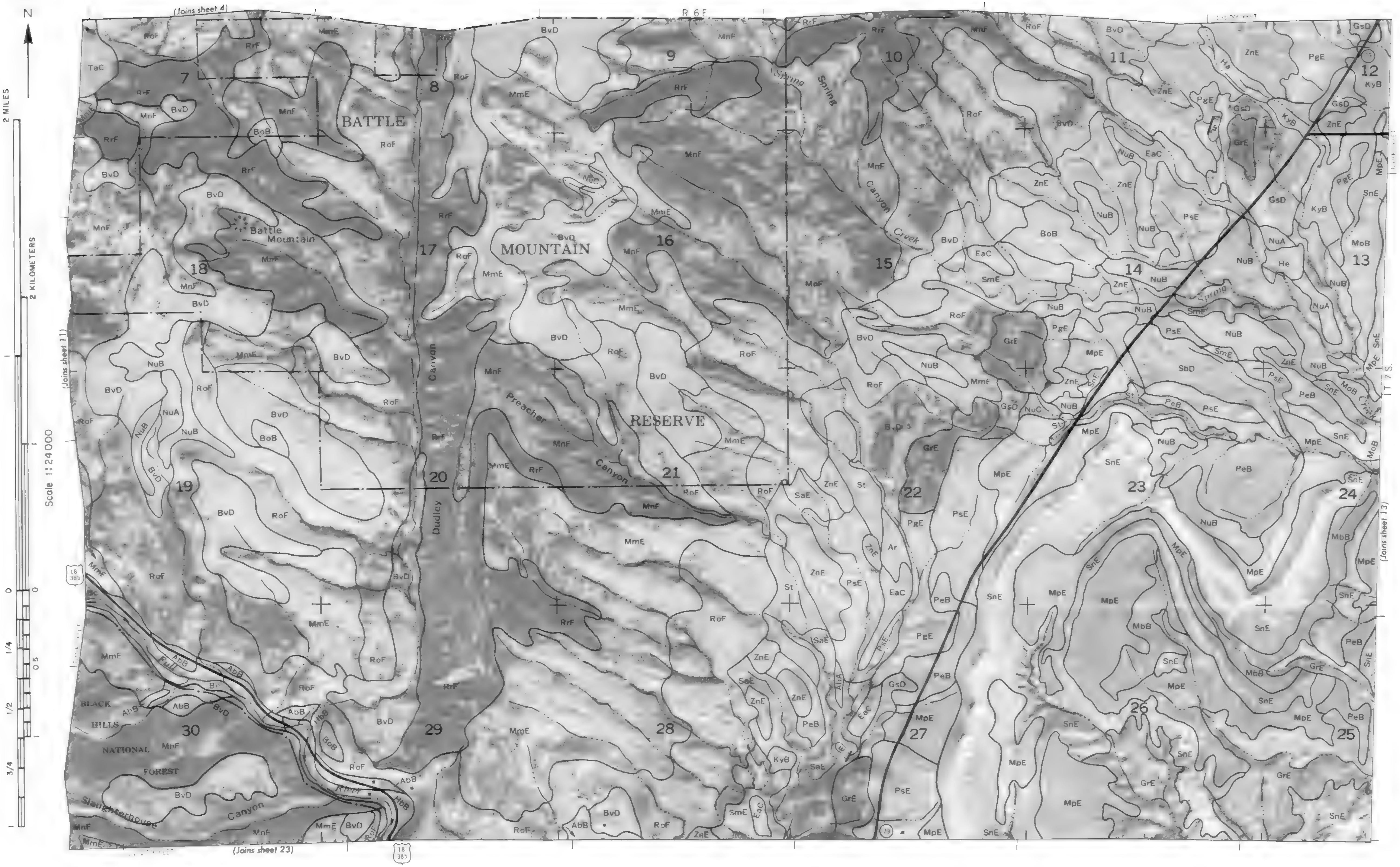

8
N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 2)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 19)
R 2 E
R 3 E
T 7 S
BLACK
HILLS
NATIONAL
FOREST
Driftwood
Coal
Canyon
Creek
Craven
Red


9
N
R. 3 E. | R. 4 E.
(Joins inset, sheet 2)
(Joins sheet 10)
(Joins sheet 8)
(Joins sheet 20)
T 7 S
BLACK HILLS NATIONAL FOREST
BRADLEY FLATS
Minnekahta
Matias Peak
Red Canyon
NORTHERN
BURLINGTON
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
1
2
0
89
18

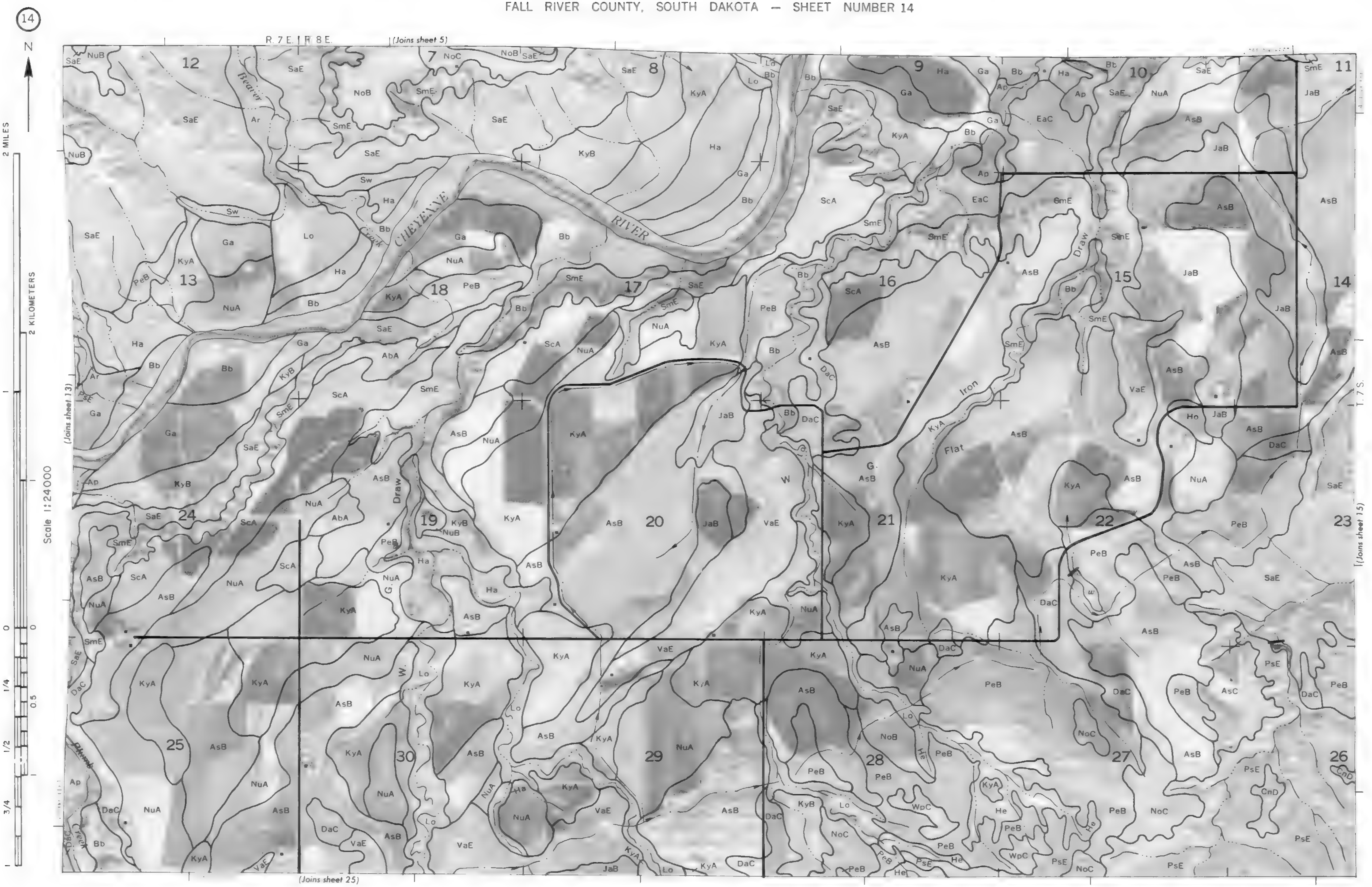
FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 10

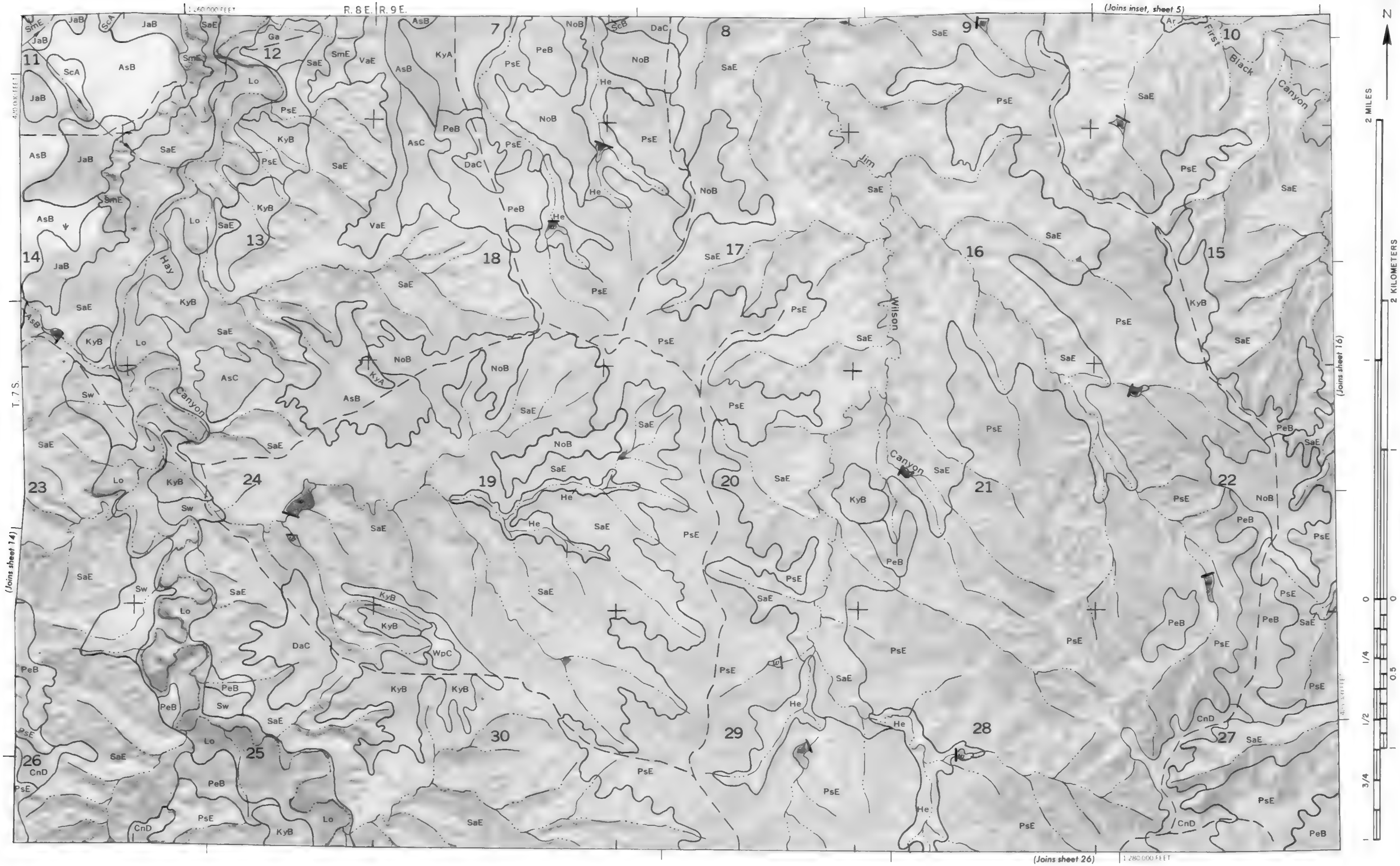


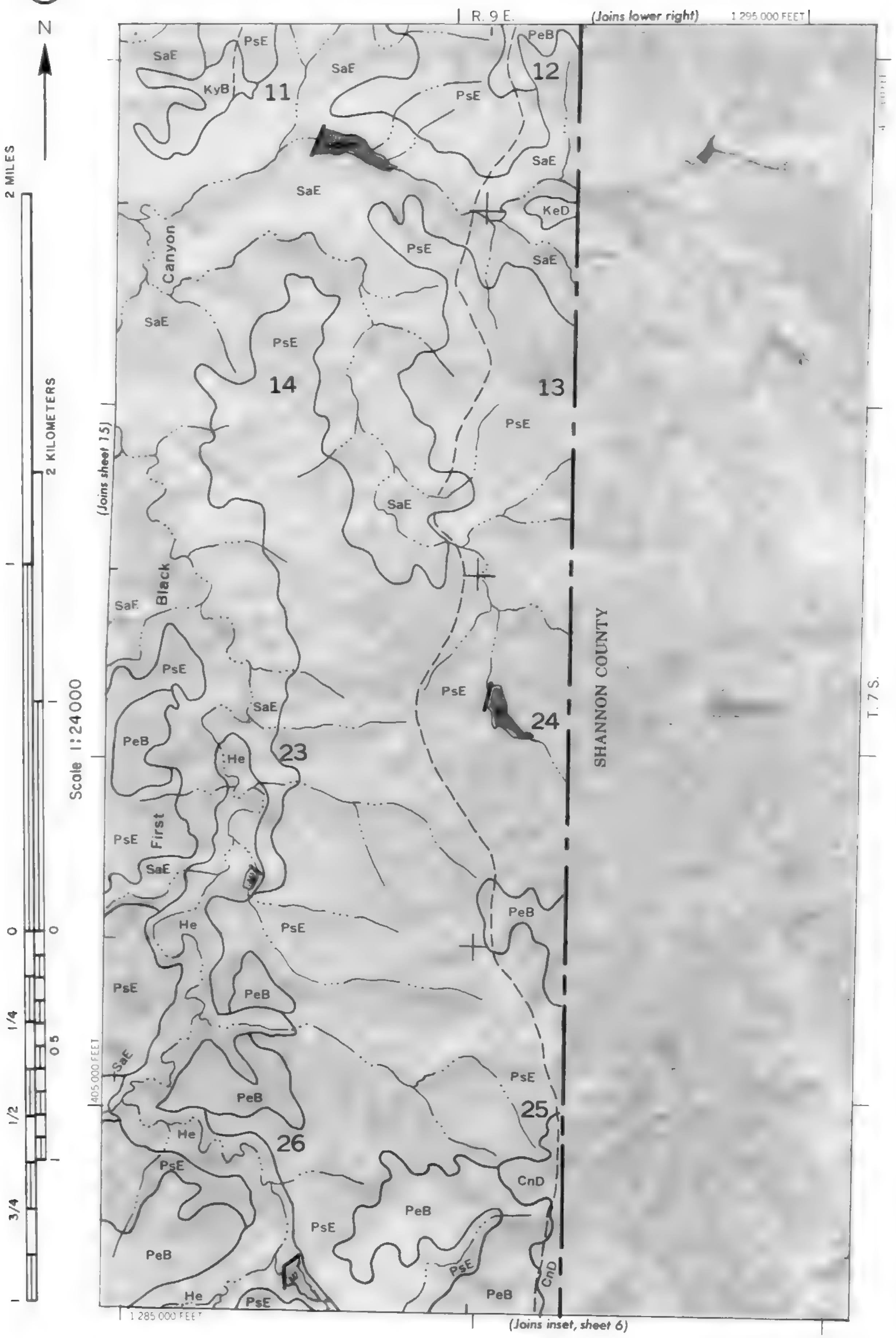

R. 5 E.
(Joins inset, sheet 3)
(Joins sheet 12)
(Joins sheet 22)
(Joins sheet 10)
T. 7 S.
BLACK HILLS
NATIONAL
FOREST
HOT SPRINGS
(county seat)
Erskine
Brook
Hot
Canyon
Fall
River
SEVEN SISTERS RANGE
Slaughterhouse
Canyon
Alabaugh
Canyon
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
PaD
PbF
TgC
NoC
NoB
NuB
HbB
BoB
Bc
Pu
BpB
SmE
SpF
ReD
RgF
TaB
TaA
TaC
ZnE
MmE
MnF
RrF
RoF
AbA
AbB
SsE
Ha
BvD
NeD
TaC
18
385
71
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5

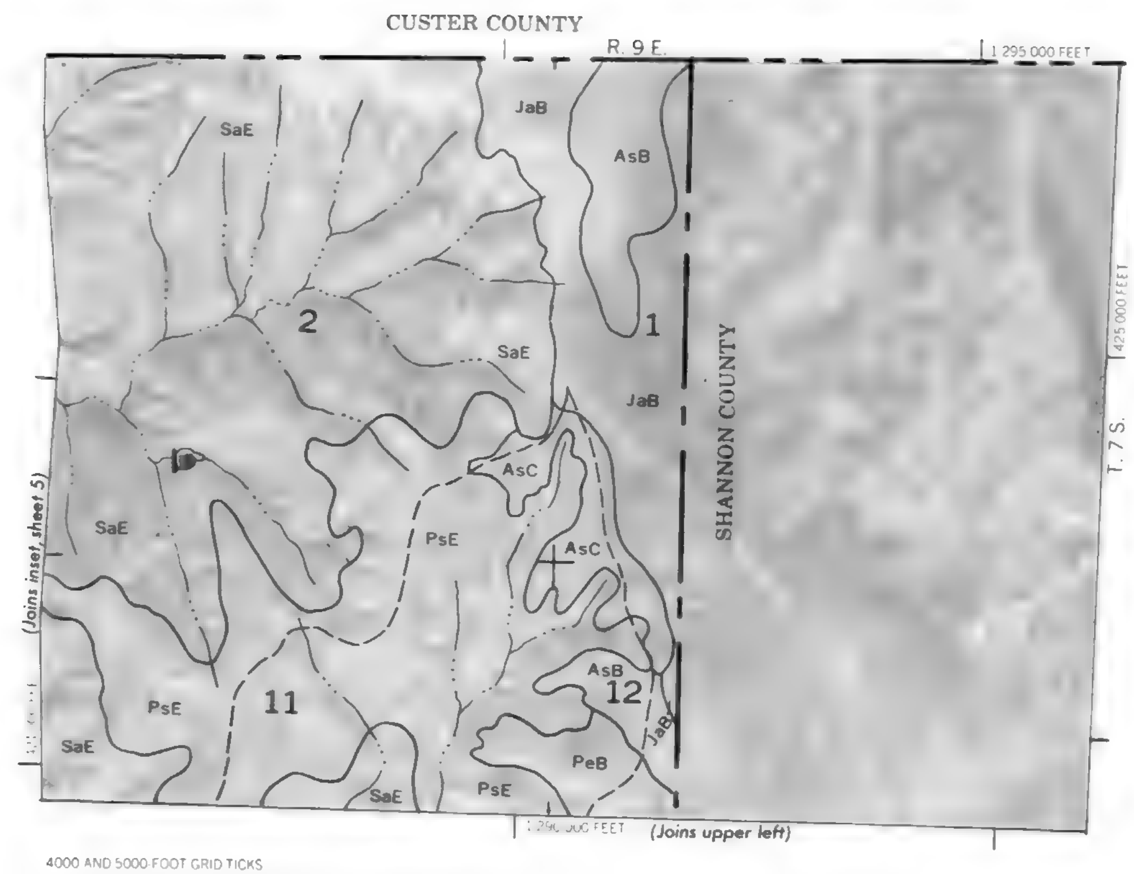

N
(Joins sheet 4)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 23)
R 6 E
T 7 S
BATTLE
MOUNTAIN
RESERVE
Battle Mountain
Dudley Canyon
Preacher Canyon
Spring Canyon Creek
Spring Creek
BLACK HILLS NATIONAL FOREST
Slaughterhouse Canyon
Fall River
Scale 1:24000
2 MILES
2 KILOMETERS

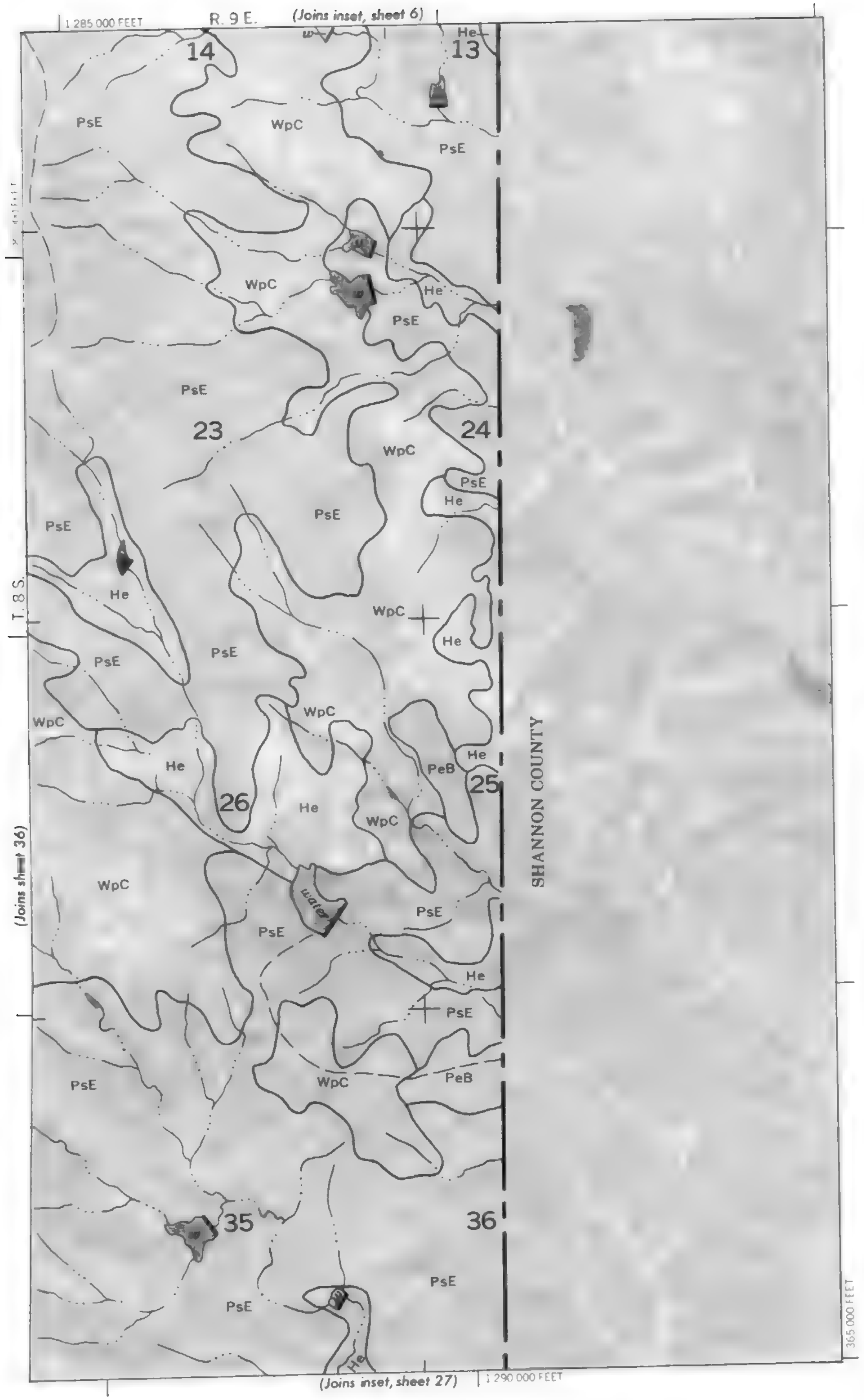

R 6 E.
R 7 E.
T. 7 S.
(Joins inset, sheet 4)
(Joins sheet 14)
(Joins sheet 12)
(Joins sheet 24)
N
2 MILES
2 KILOMETERS
Scale 1:24000
CHEYENNE RIVER
Beaver Creek
Elm Creek
Spring Creek
Plumb Creek
CHICAGO NORTHWESTERN
Oral

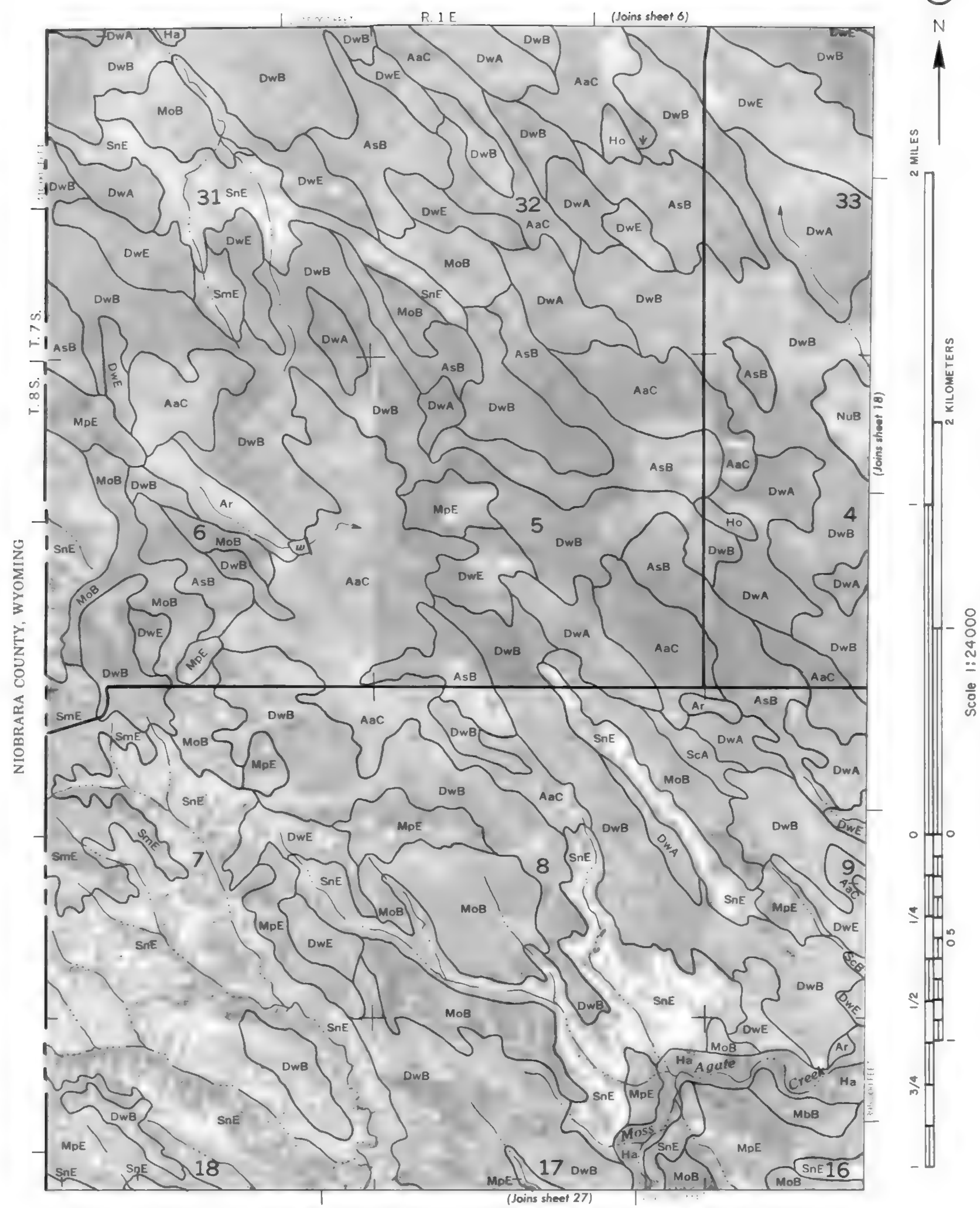

14
N
R. 7 E. | R. 8 E.
(Joins sheet 5)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 25)
T. 7 S.
2 MILES
2 KILOMETERS
Scale 1:24000
CHEYENNE RIVER
Beaver Creek
Iron Draw
Flat
Plumb Creek
12
7
8
9
10
11
13
18
17
16
15
14
24
19
20
21
22
23
25
30
29
28
27
26


R. 8 E. | R. 9 E.
(Joins inset, sheet 5)
(Joins sheet 16)
(Joins sheet 26)
(Joins sheet 14)
T. 7 S.
1 280 000 FEET
N
2 MILES
2 KILOMETERS
Scale 1:24 000
First Black Canyon
Jim Wilson Canyon
Hay Canyon
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

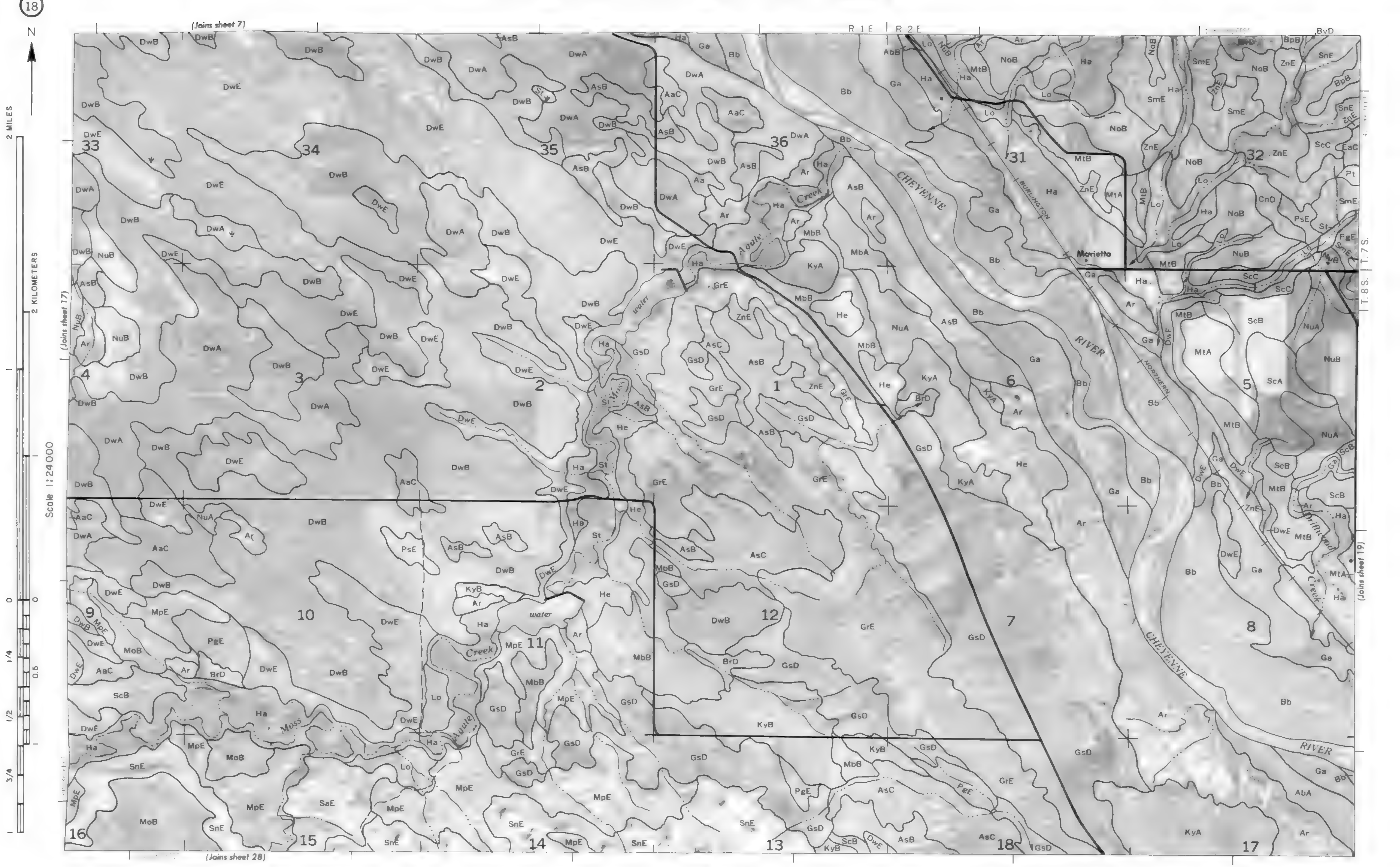

N
Scale 1:24000
2 MILES
2 KILOMETERS
0
1/4
1/2
3/4
0
0.5
1
R. 9 E.
(Joins lower right)
1 295 000 FEET
(Joins sheet 15)
405 000 FEET
1 285 000 FEET
(Joins inset, sheet 6)
T. 7 S.
SHANNON COUNTY
Canyon
Black
First
11
12
13
14
23
24
25
26
SaE
PsE
KyB
PeB
KeD
He
CnD

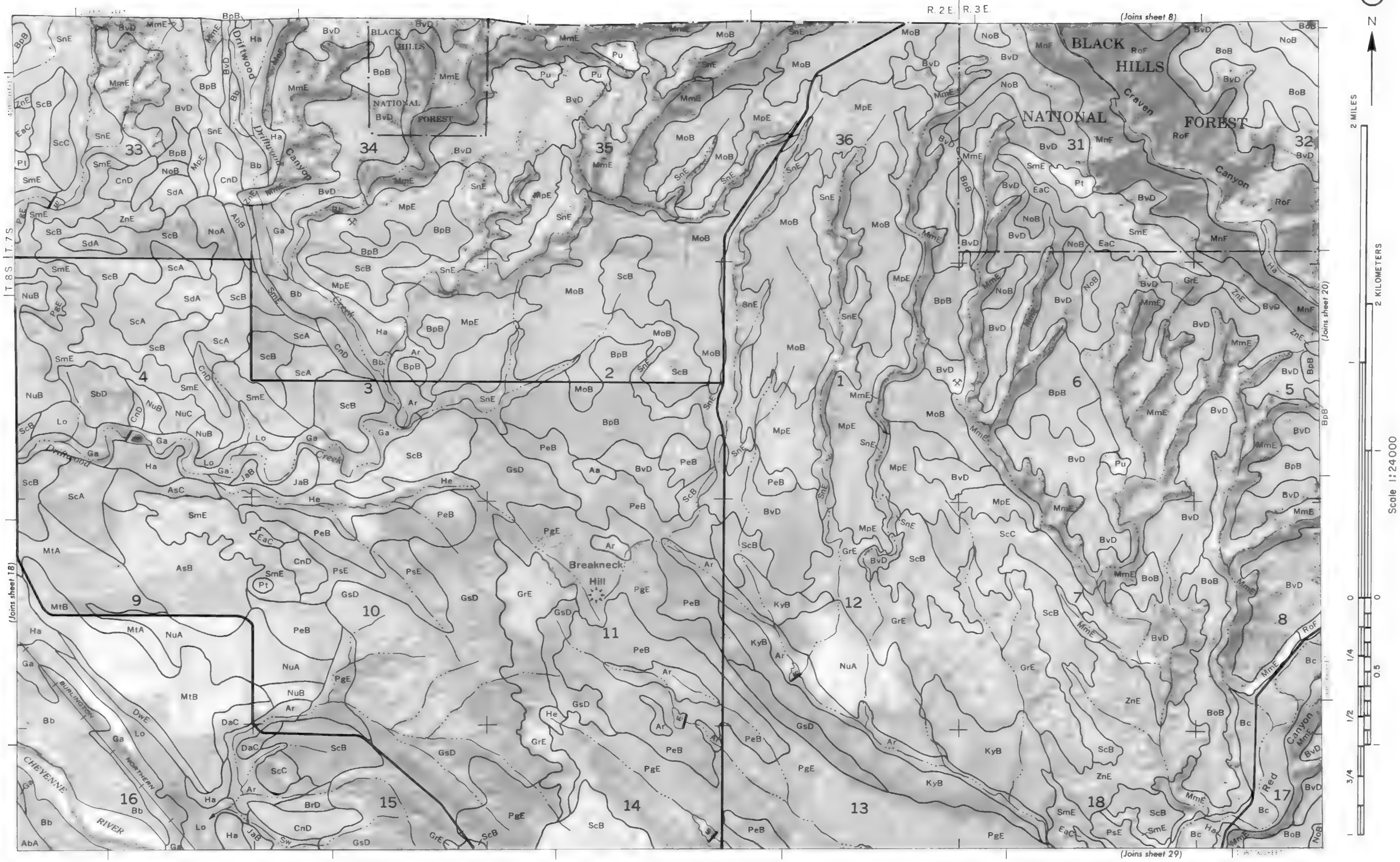

CUSTER COUNTY
R. 9 E.
1 295 000 FEET
SHANNON COUNTY
T. 7 S.
425 000 FEET
(Joins inset, sheet 5)
(Joins upper left)
1
2
11
12
JaB
AsB
SaE
AsC
PsE
PeB
4000 AND 5000 FOOT GRID TICKS

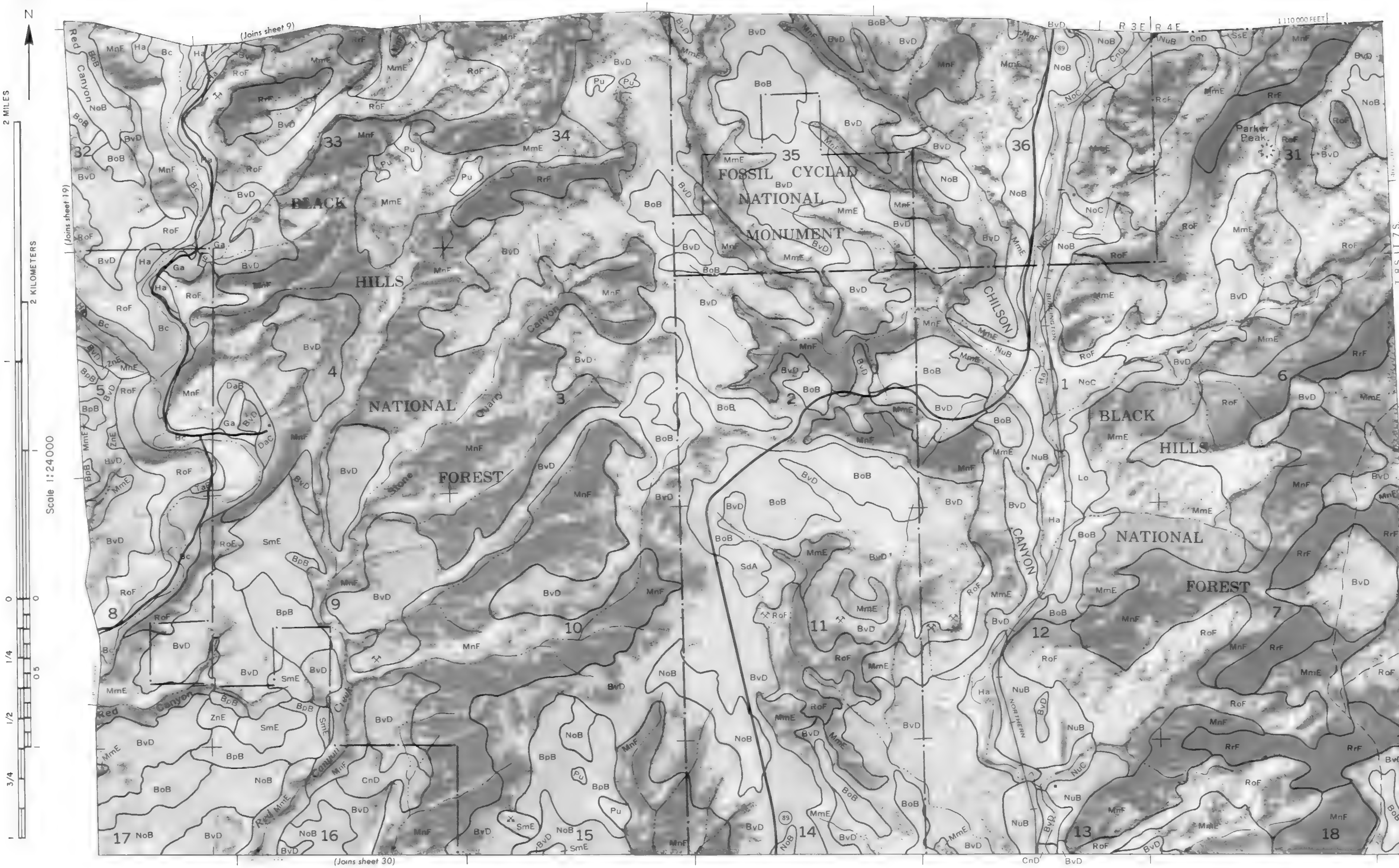

1 285 000 FEET
R. 9 E.
(Joins inset, sheet 6)
T. 8 S.
(Joins sheet 36)
SHANNON COUNTY
(Joins inset, sheet 27)
1 290 000 FEET
365 000 FEET
water

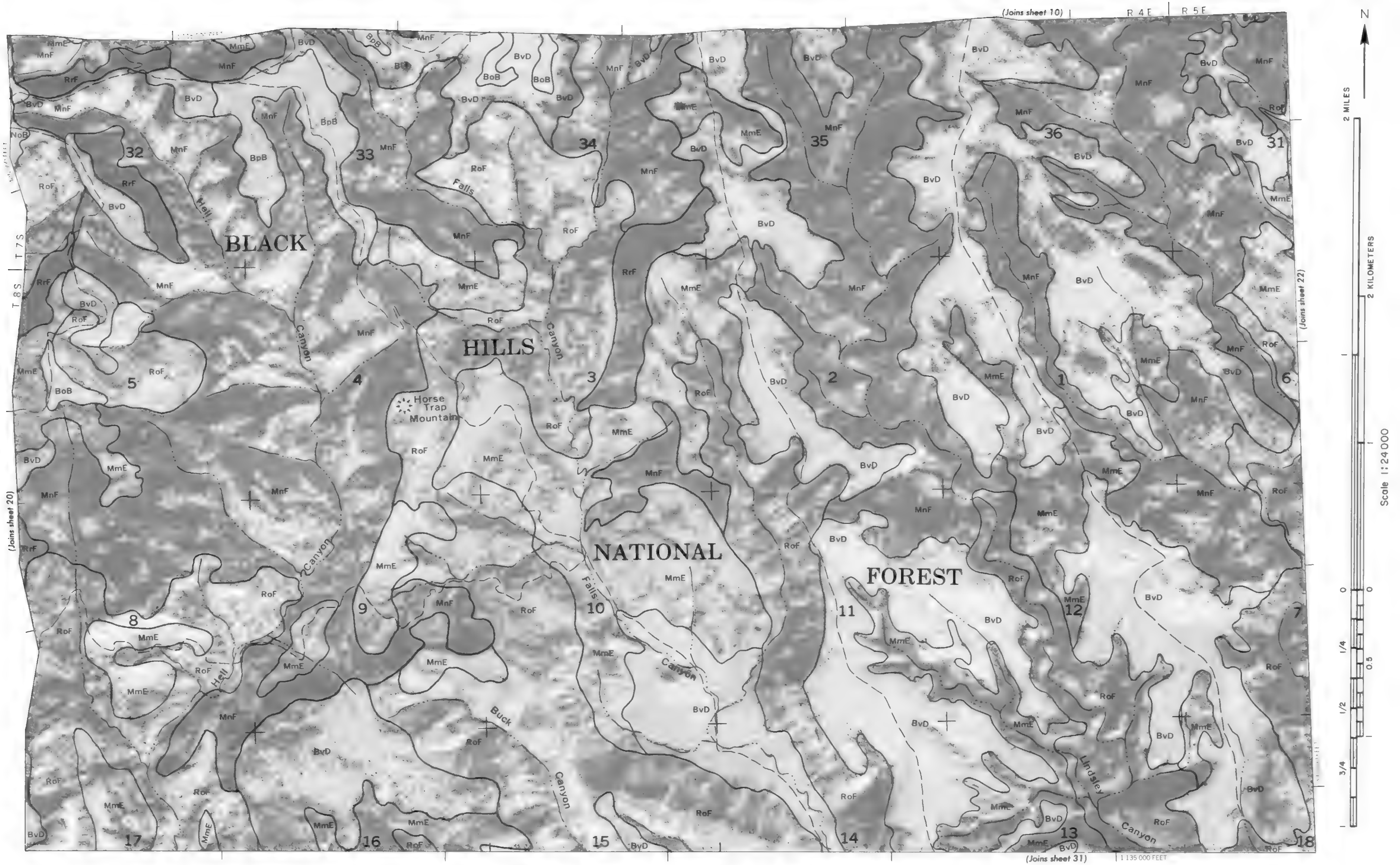

R. 1 E.
(Joins sheet 6)
T. 7 S.
T. 8 S.
NIOBRARA COUNTY, WYOMING
(Joins sheet 18)
(Joins sheet 27)
Agate Creek
Moss
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0
0.5

FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 18

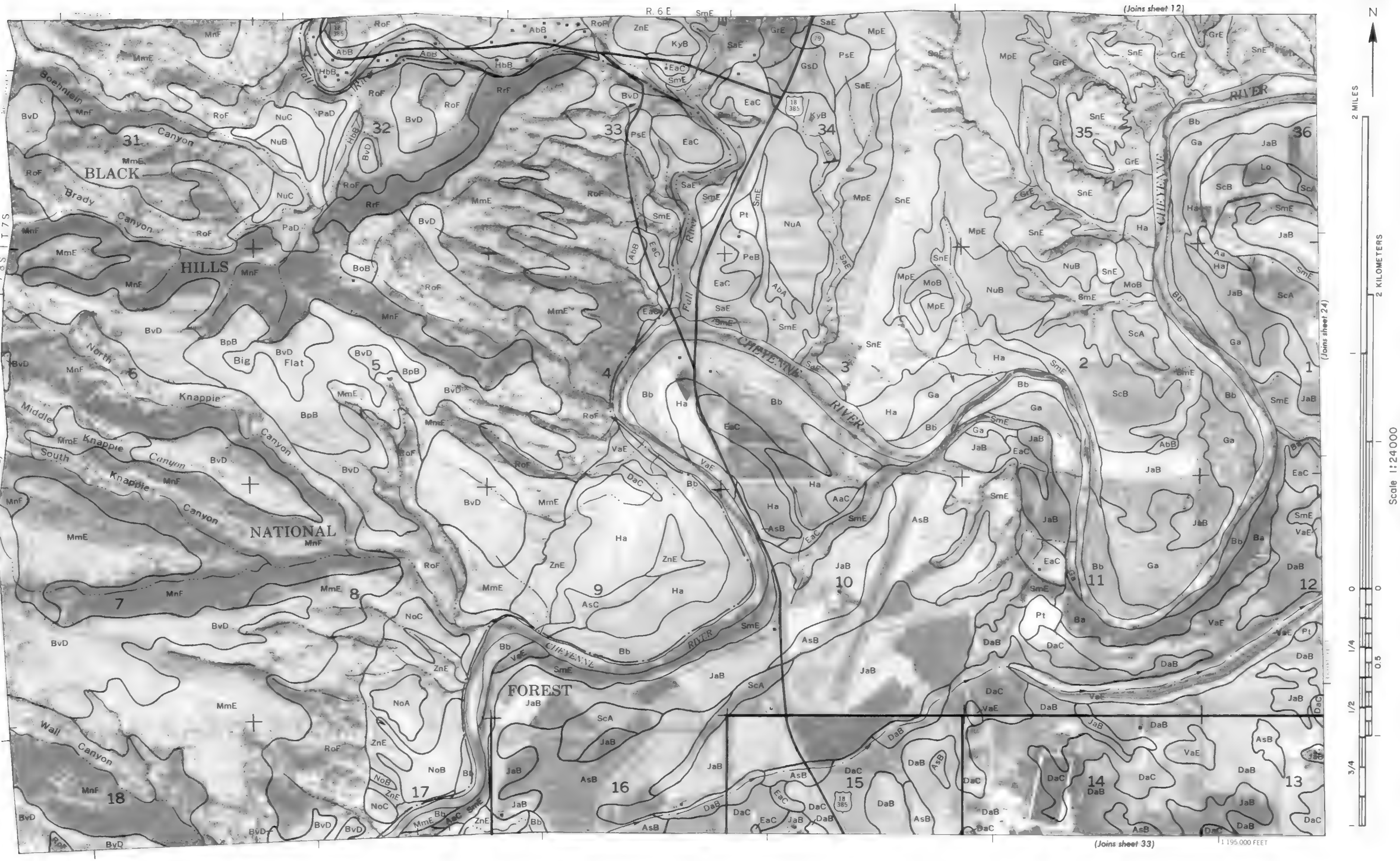



R. 2 E.
R. 3 E.
(Joins sheet 8)
(Joins sheet 20)
(Joins sheet 29)
(Joins sheet 18)
T. 7 S.
T. 8 S.
BLACK HILLS NATIONAL FOREST
Driftwood Canyon
Driftwood Creek
Craven Canyon
Red Canyon
Breakneck Hill
CHEYENNE RIVER
BURLINGTON NORTHERN
N
2 MILES
2 KILOMETERS
Scale 1:24000

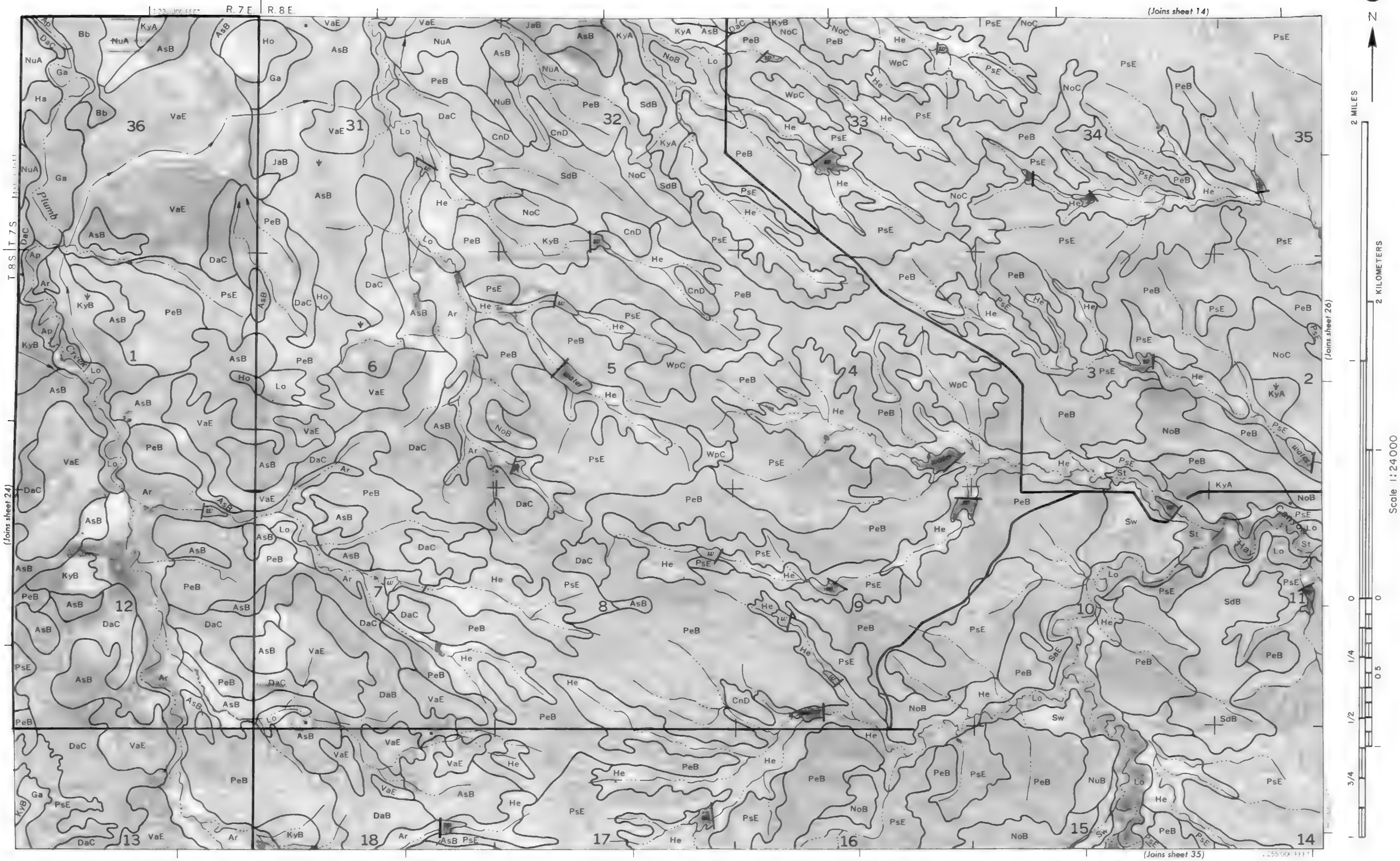

N
2 MILES
2 KILOMETERS
Scale 1:24 000
(Joins sheet 9)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 30)
1 110 000 FEET
R 3 E
R 4 E
T 7 S.
T 8 S
BLACK HILLS NATIONAL FOREST
FOSSIL CYCLAD NATIONAL MONUMENT
CHILSON CANYON
Parker Peak
Red Canyon
Stone Quarry Canyon
Red Canyon
Red Canyon
BURLINGTON NORTHERN
89
32
33
34
35
36
31
5
4
3
2
1
6
8
9
10
11
12
7
17
16
15
14
13
18
MnF
MmE
RoF
RrF
BvD
BoB
NoB
Ha
Bc
Ga
Pu
NoC
NuB
CnD
SsE
BpB
ZnE
DaB
DaC
TaB
SmE
SdA
NuC
Lo

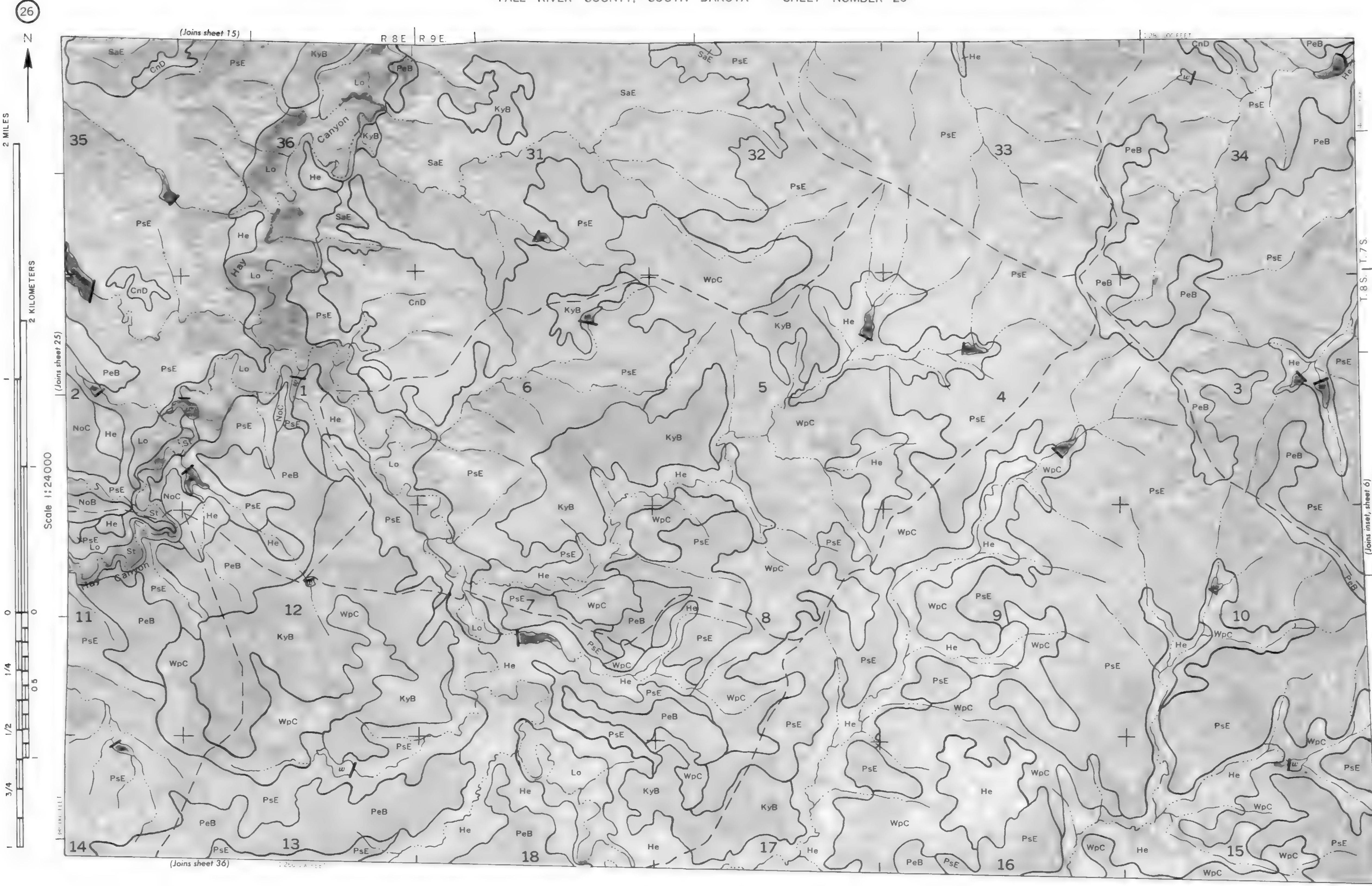

21
N
(Joins sheet 10)
R 4 E
R 5 E
T 7 S
T 8 S
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 31)
BLACK
HILLS
NATIONAL
FOREST
Horse Trap Mountain
Hell Canyon
Falls Canyon
Buck Canyon
Lindsey Canyon
2 MILES
2 KILOMETERS
Scale 1:24 000
1 135 000 FEET

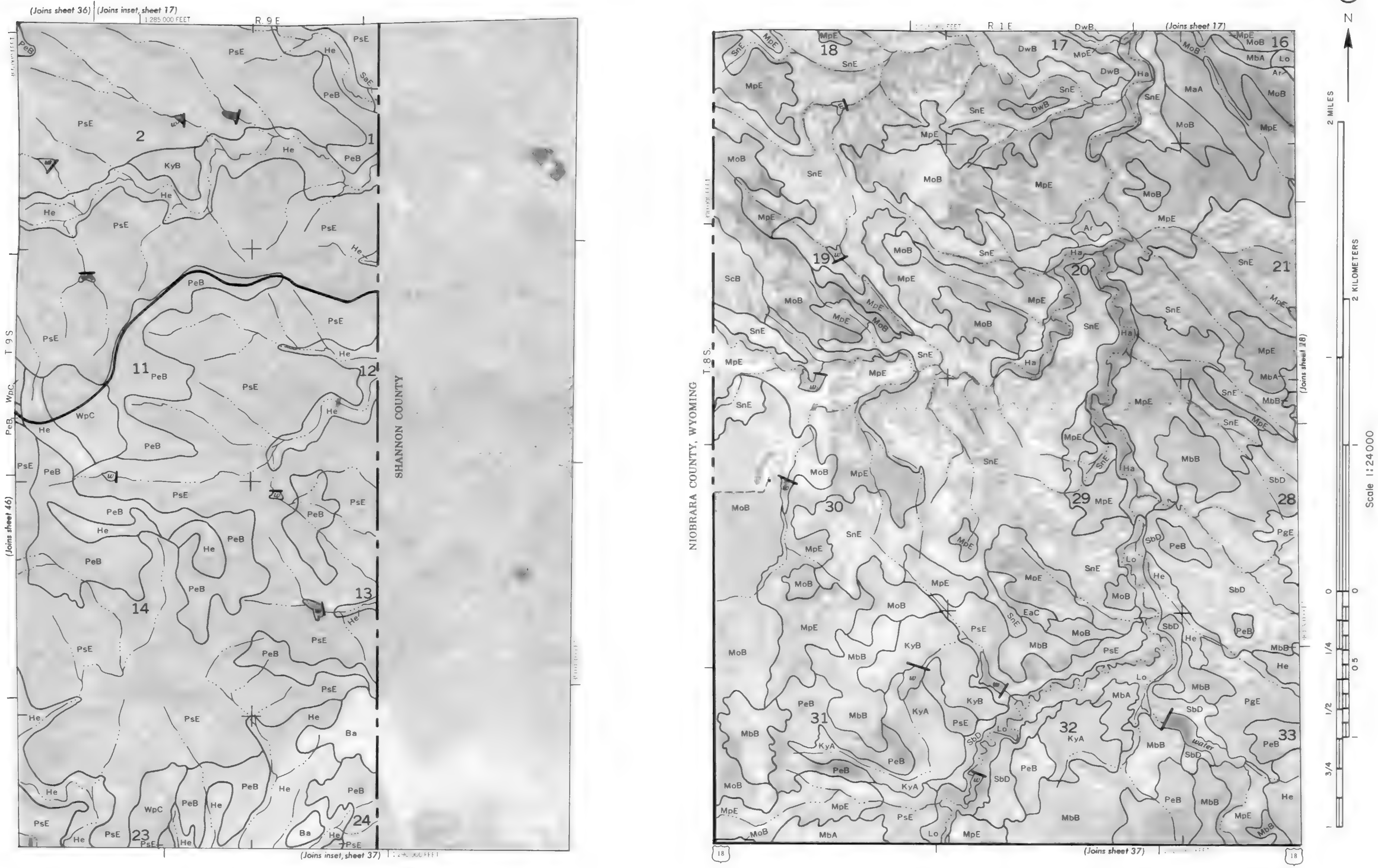

22
N
2 MILES
2 KILOMETERS
Scale 1:24 000
(Joins sheet 11)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 32)
R 5 E.
T. 7 S.
T. 8 S.
BLACK
HILLS
NATIONAL
FOREST
SEVEN SISTERS RANGE
Brady Canyon
North Knapple Canyon
Middle Knapple Canyon
South Knapple Canyon
Wall Canyon
Whaley Canyon
Alabaugh Canyon
Payne Canyon
Canyon
71
1 140 000 FEET

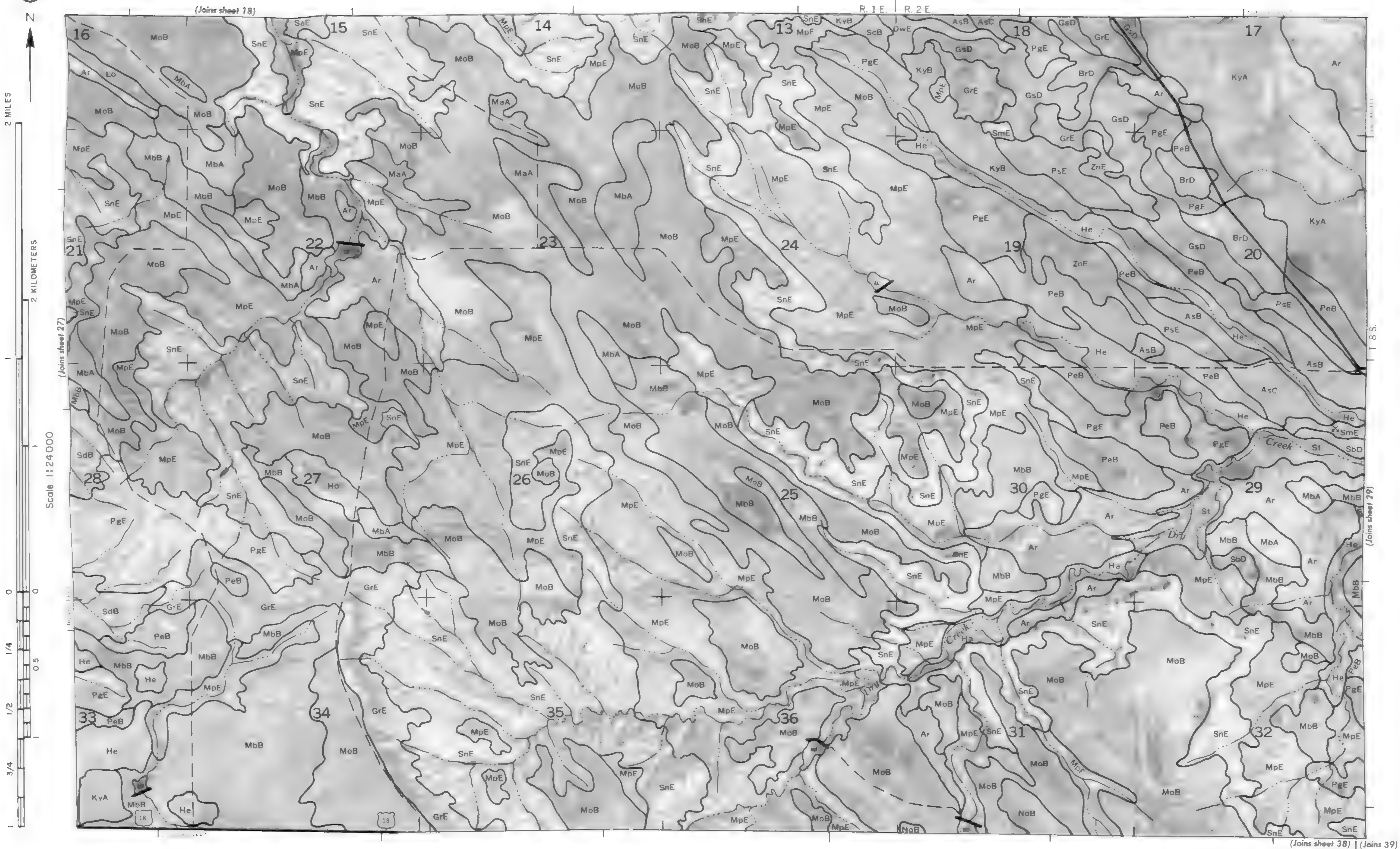

(Joins sheet 12)
(Joins sheet 24)
(Joins sheet 33)
(Joins sheet 22)
R. 6 E
T 7 S
T 8 S
BLACK
HILLS
NATIONAL
FOREST
CHEYENNE RIVER
Fall River
Boehnlein Canyon
Brady Canyon
North Knappie Canyon
Middle Knappie Canyon
South Knappie Canyon
Wall Canyon
Big Flat
31
32
33
34
35
36
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
N
2 MILES
2 KILOMETERS
Scale 1:24 000
1 195 000 FEET

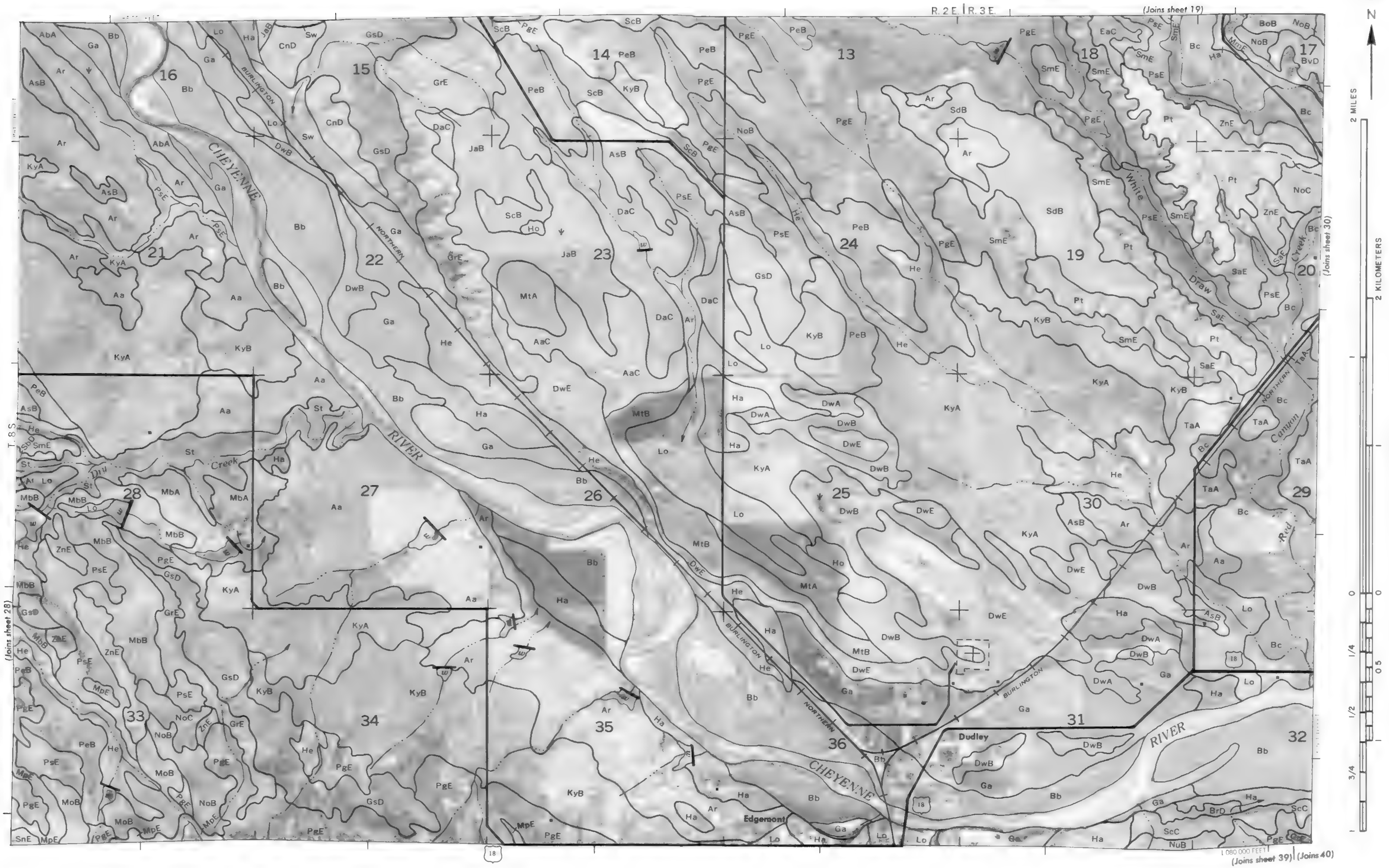

24
N
(Joins sheet 13)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 34)
R 6 E | R 7 E
T 7 S
T 8 S
2 MILES
2 KILOMETERS
Scale 1:24000
CHEYENNE
RIVER
Spring
Creek
Sand
Creek
CHICAGO
NORTHWESTERN
Slate
Draw

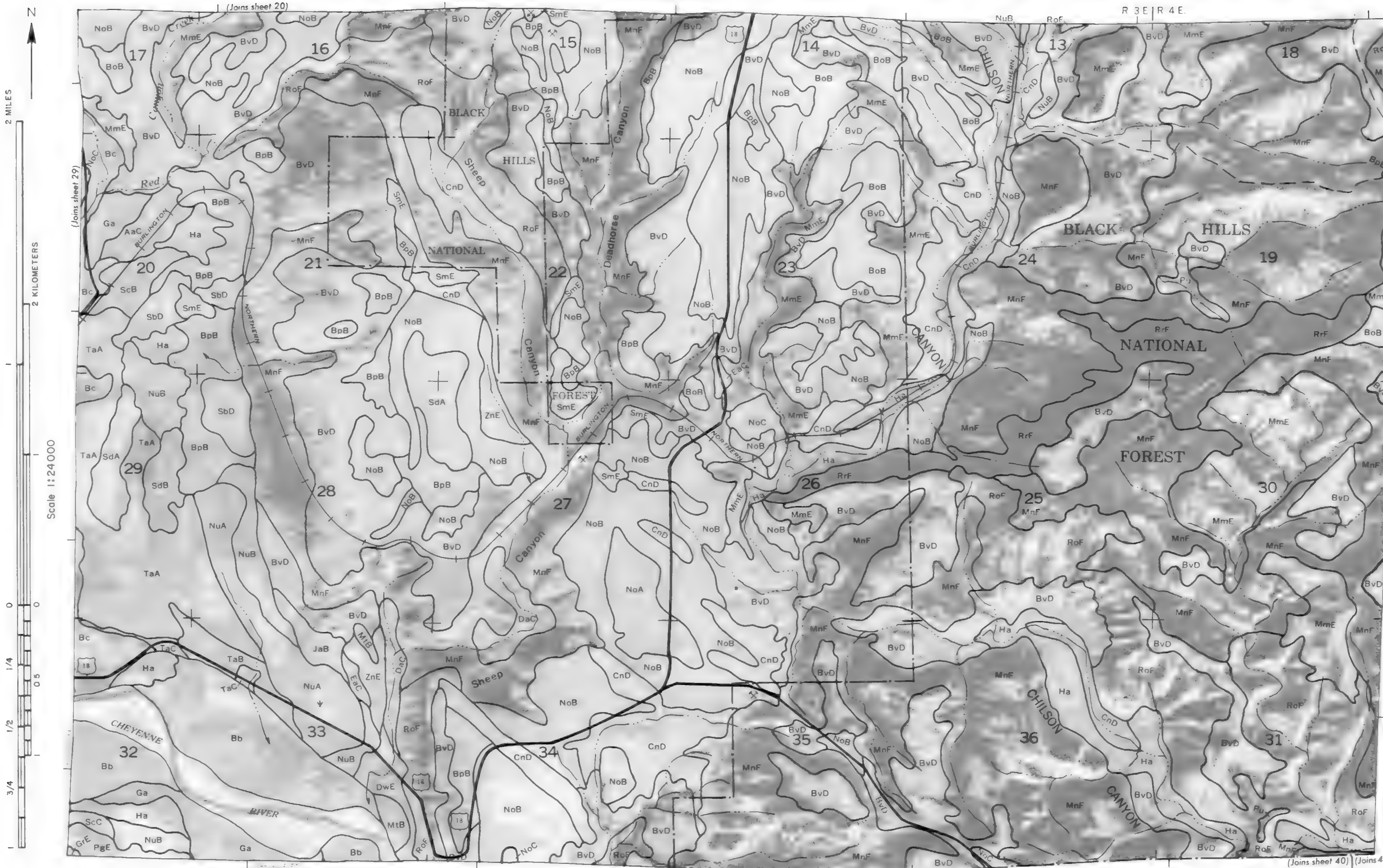

(Joins sheet 14)
(Joins sheet 26)
(Joins sheet 24)
(Joins sheet 35)
R. 7 E.
R. 8 E.
T. 7 S.
T. 8 S.
N
Plumb Creek
Hay Canyon
36
31
32
33
34
35
1
6
5
4
3
2
12
7
8
9
10
11
13
18
17
16
15
14
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
0.5
VaE
AsB
PeB
PsE
He
DaC
NoB
NoC
WpC
SdB
KyA
KyB
CnD
Lo
Ar
Ga
Ho
Sw
St
NuA
NuB
JaB
Bb
Ap
Ha
DaB
SeE
water


26
N
(Joins sheet 15)
R. 8 E. | R. 9 E.
(Joins sheet 25)
(Joins sheet 36)
(Joins inset, sheet 6)
T. 7 S.
T. 8 S.
Hay Canyon
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
35
36
31
32
33
34
2
1
6
5
4
3
11
12
7
8
9
10
14
13
18
17
16
15

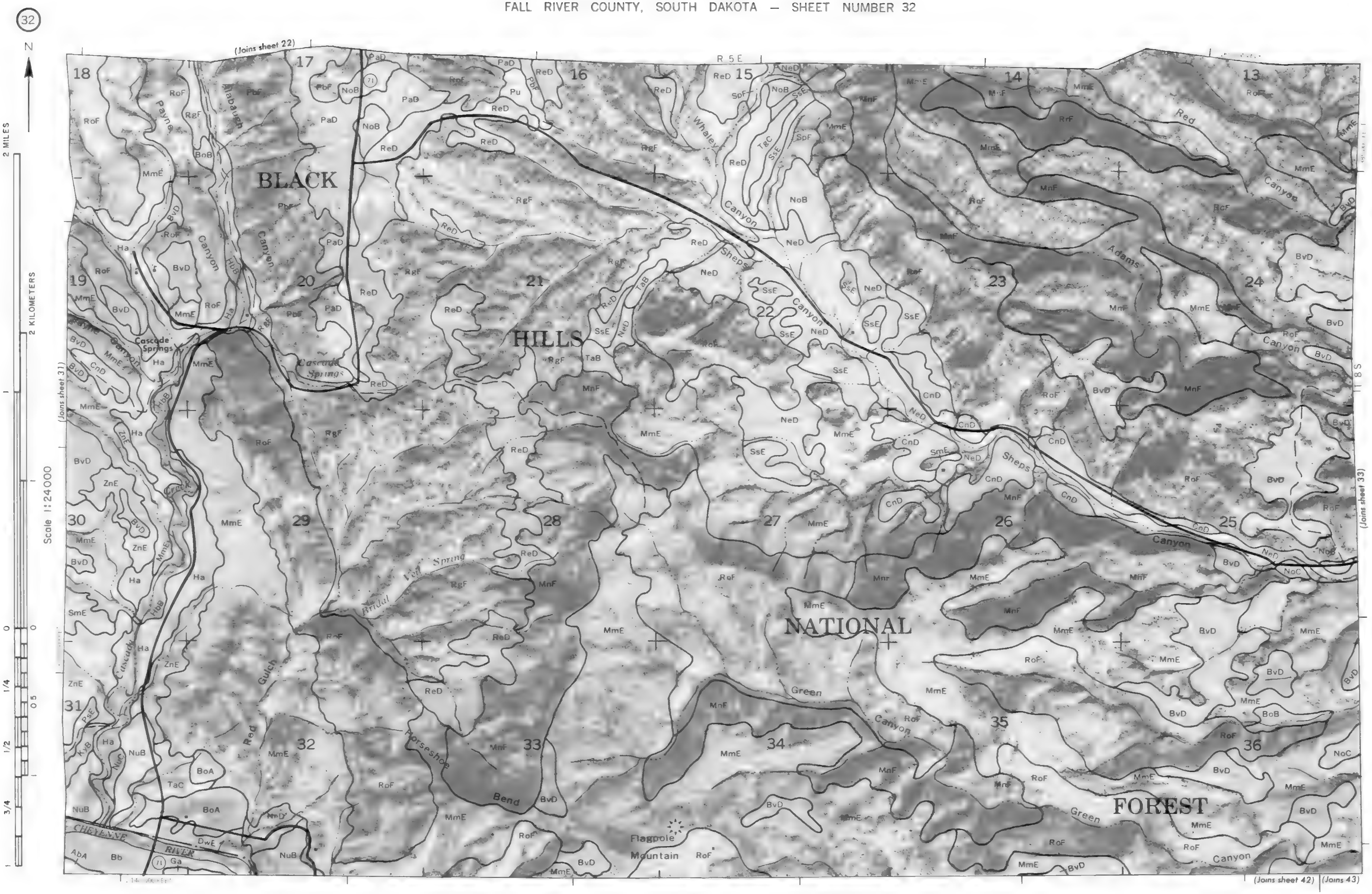

27
N
(Joins sheet 36)
(Joins inset, sheet 17)
1 285 000 FEET
R. 9 E.
T. 9 S.
(Joins sheet 46)
SHANNON COUNTY
(Joins inset, sheet 37)
R. 1 E.
(Joins sheet 17)
T. 8 S.
NIOBRARA COUNTY, WYOMING
(Joins sheet 28)
(Joins sheet 37)
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
1
0.5
water

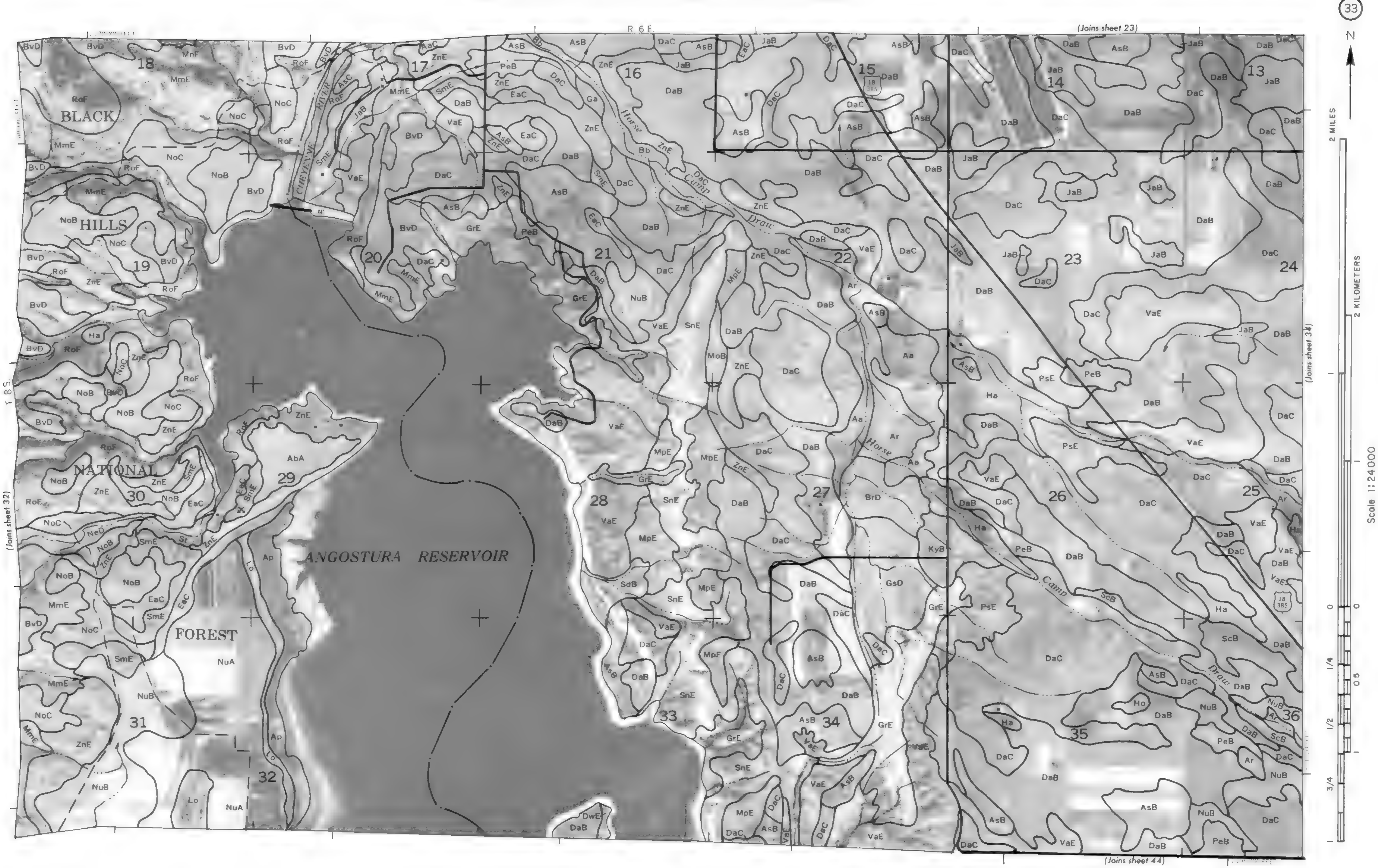

(Joins sheet 18)
R.1E.
R.2E.
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 38)
(Joins 39)
T 8 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
Dry Creek

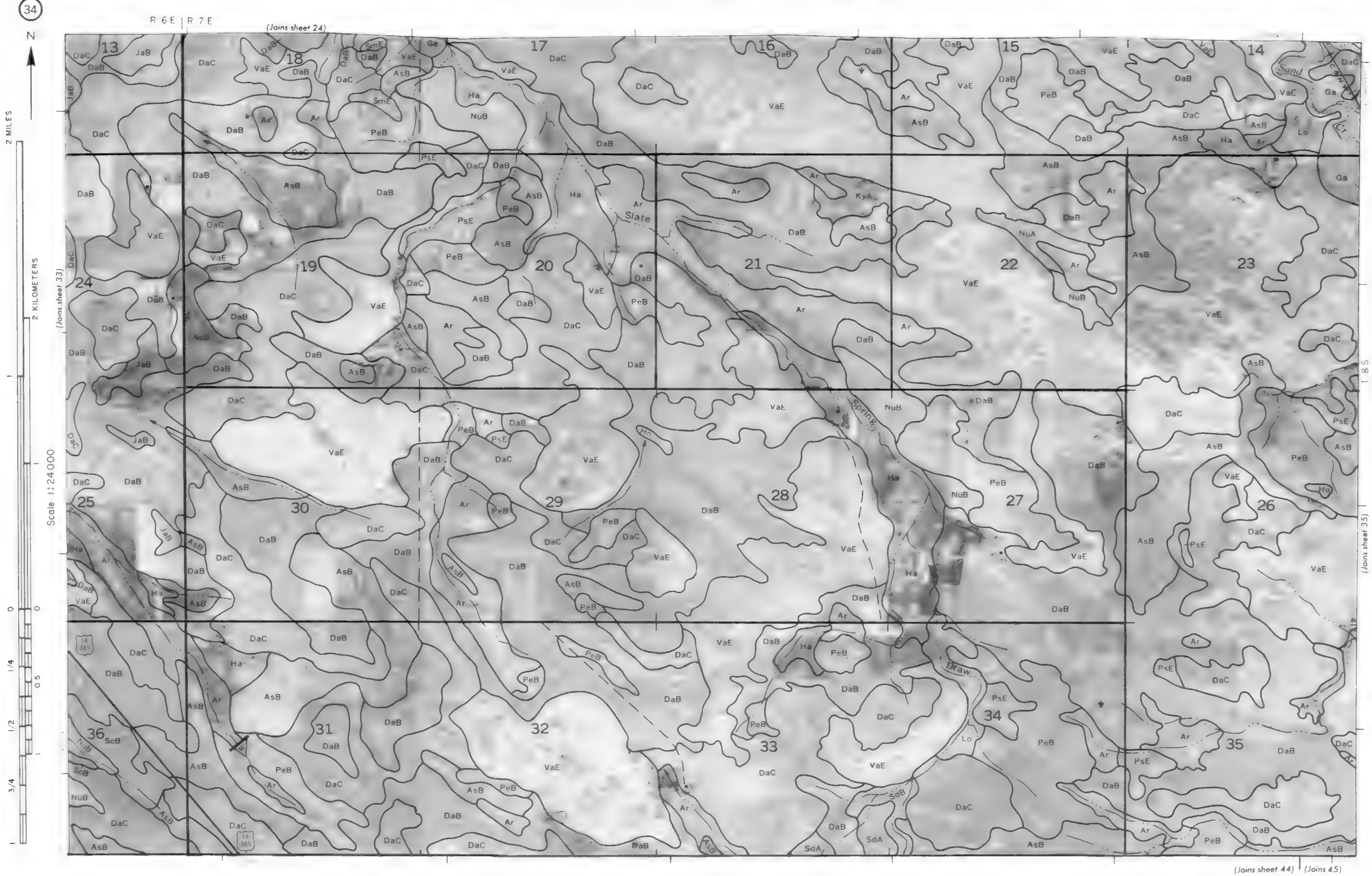

29
N
R. 2 E. | R. 3 E.
(Joins sheet 19)
(Joins sheet 30)
(Joins sheet 28)
(Joins sheet 39)
(Joins 40)
T. 8 S.
CHEYENNE
RIVER
BURLINGTON
NORTHERN
Dry Creek
White Draw
Red Canyon
Dudley
Edgemont
1 080 000 FEET
Scale 1:24000
2 MILES
2 KILOMETERS
0
1/4
1/2
3/4
0.5
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

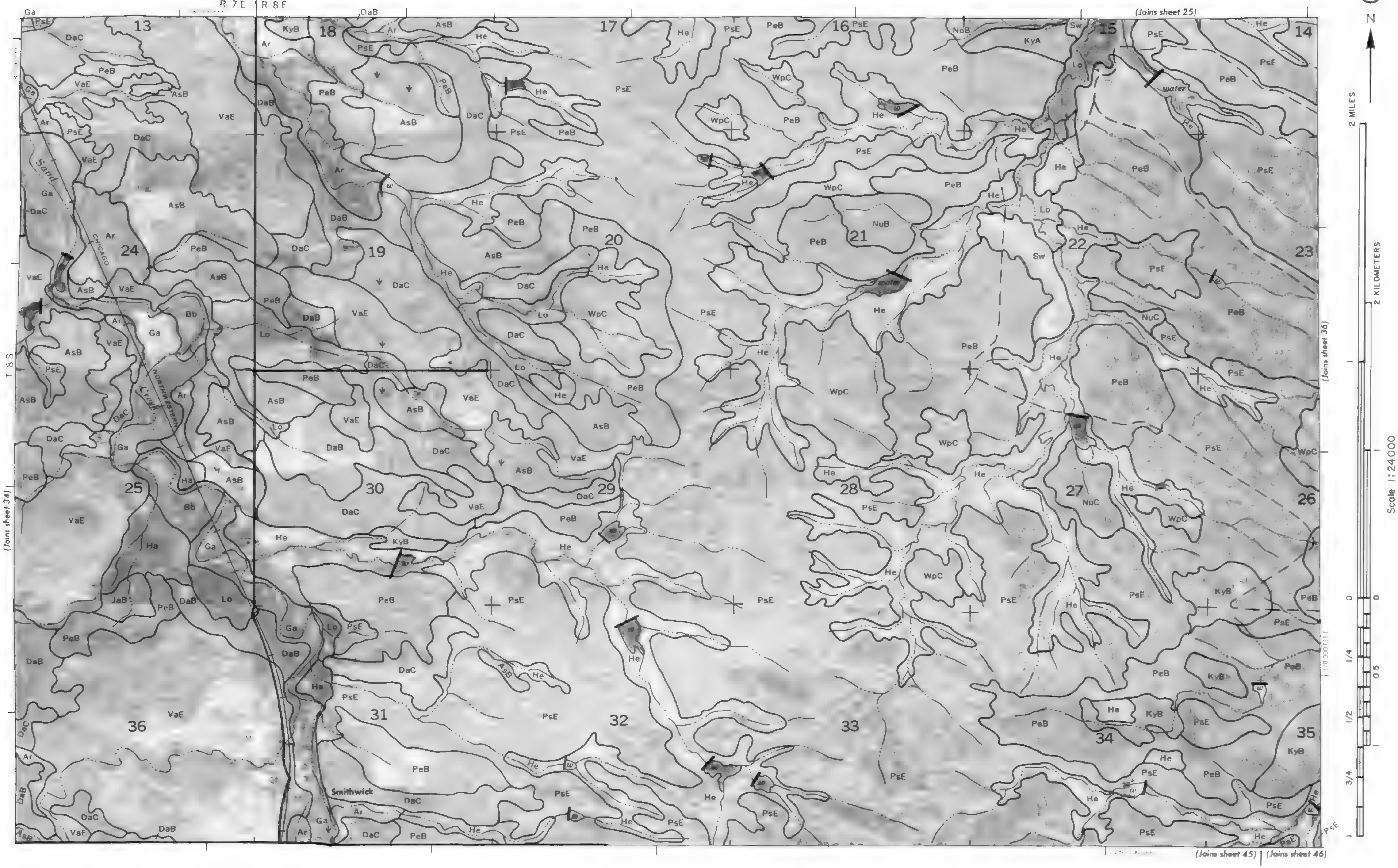

N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 20)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 40)
(Joins 41)
R 3 E | R 4 E
T 8 S.
BLACK HILLS NATIONAL FOREST
Sheep Canyon
Deadhorse Canyon
CHILSON CANYON
Red Canyon Creek
BURLINGTON NORTHERN
CHEYENNE RIVER
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

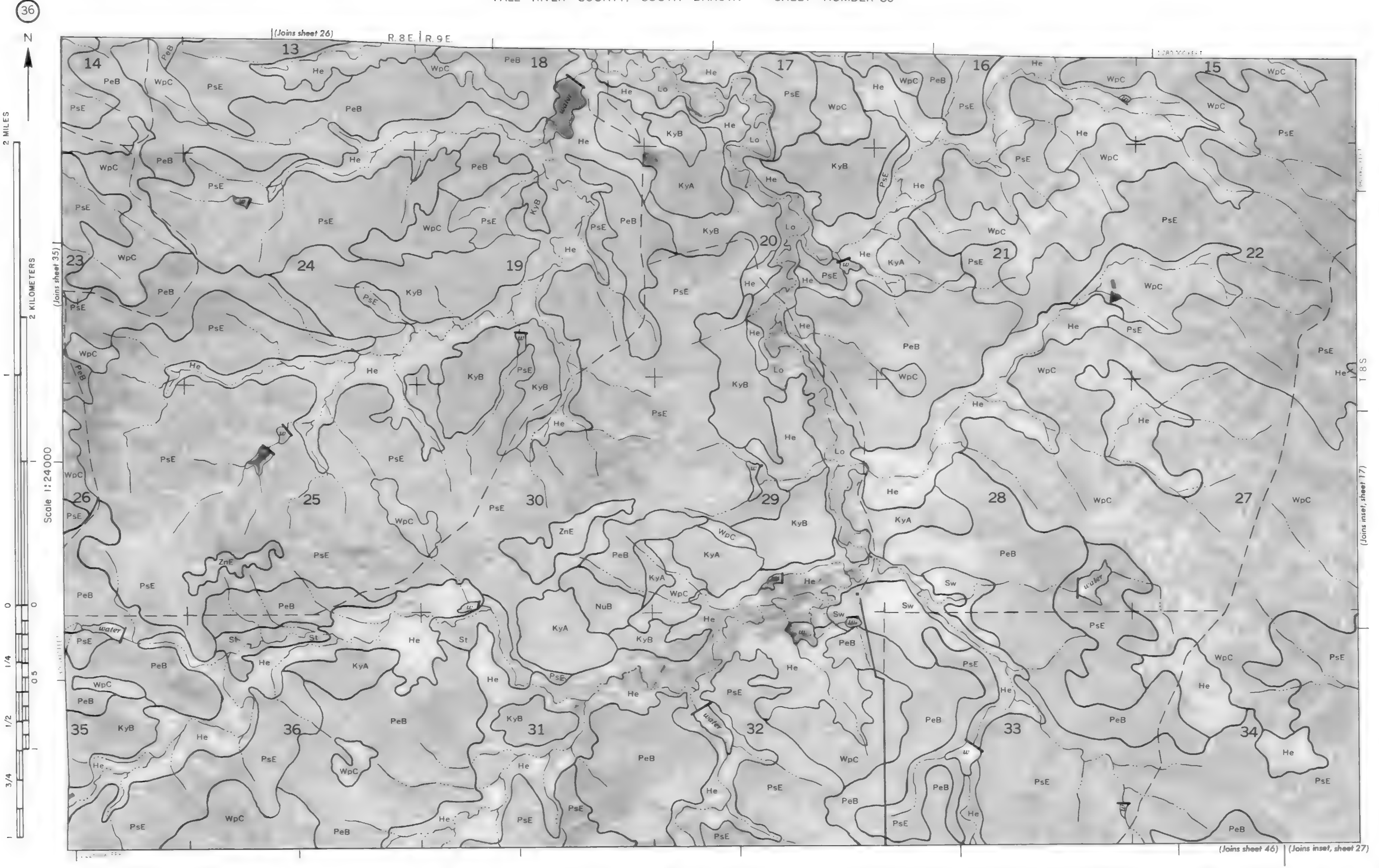

31
N
(Joins sheet 21)
R 4 E | R 5 E
BLACK
HILLS
NATIONAL
FOREST
Flint Hill
Wildcat
Buck
Canyon
Hell
Falls
Lindsley
Payne
Cedar
Mike
Dick
Middle
CHEYENNE
RIVER
T 8 S
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 41)
(Joins 42)
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5

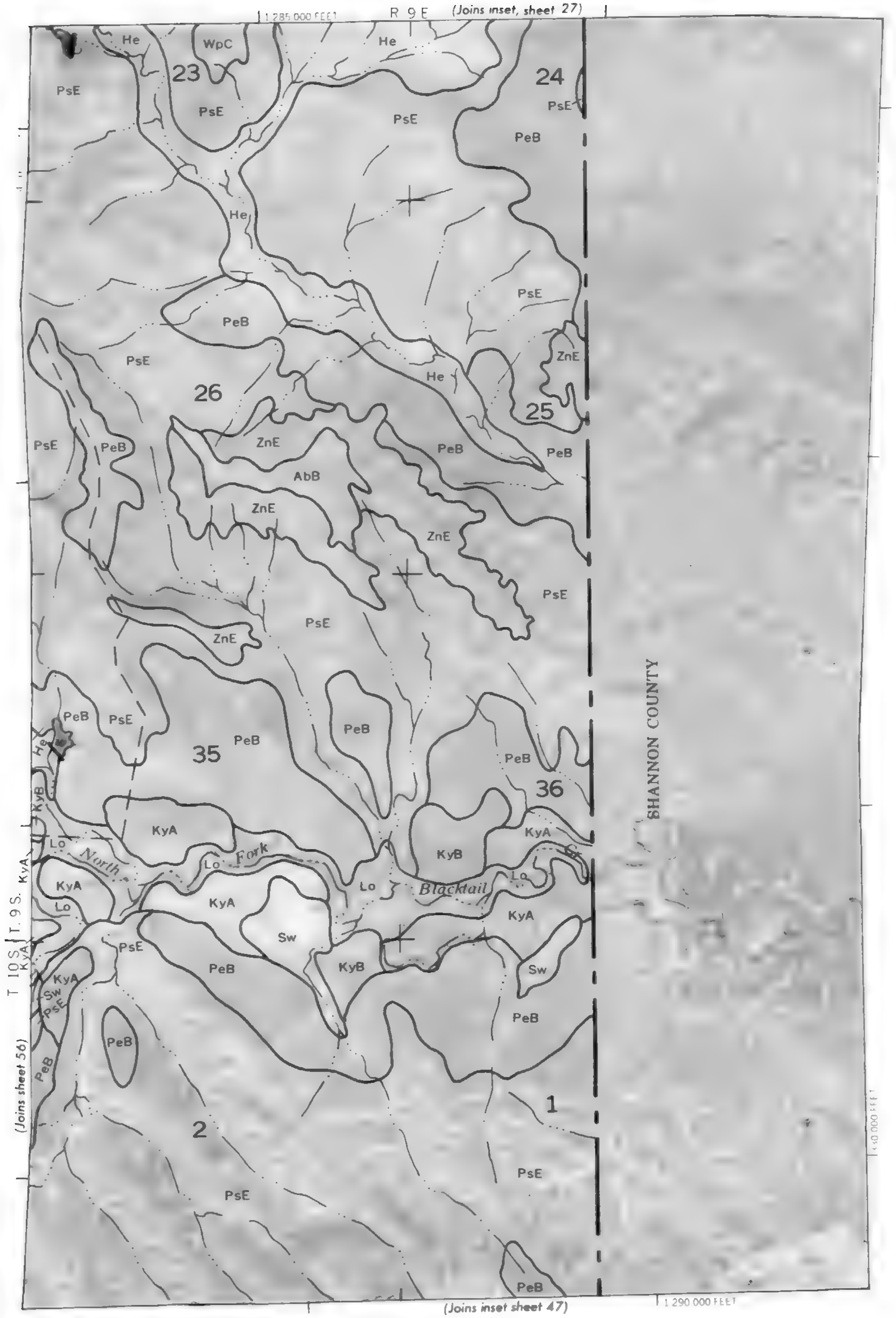

32
N
2 MILES
2 KILOMETERS
Scale 1:24 000
(Joins sheet 22)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 42)
(Joins 43)
R 5 E
T 8 S
BLACK
HILLS
NATIONAL
FOREST
Cascade Springs
Payne Canyon
Alabaugh Canyon
Whaley Canyon
Sheps Canyon
Red Canyon
Adams
Cascade Creek
Bridal Veil Spring
Red Gulch
Horseshoe Bend
Green Canyon
Flagpole Mountain
CHEYENNE RIVER
71

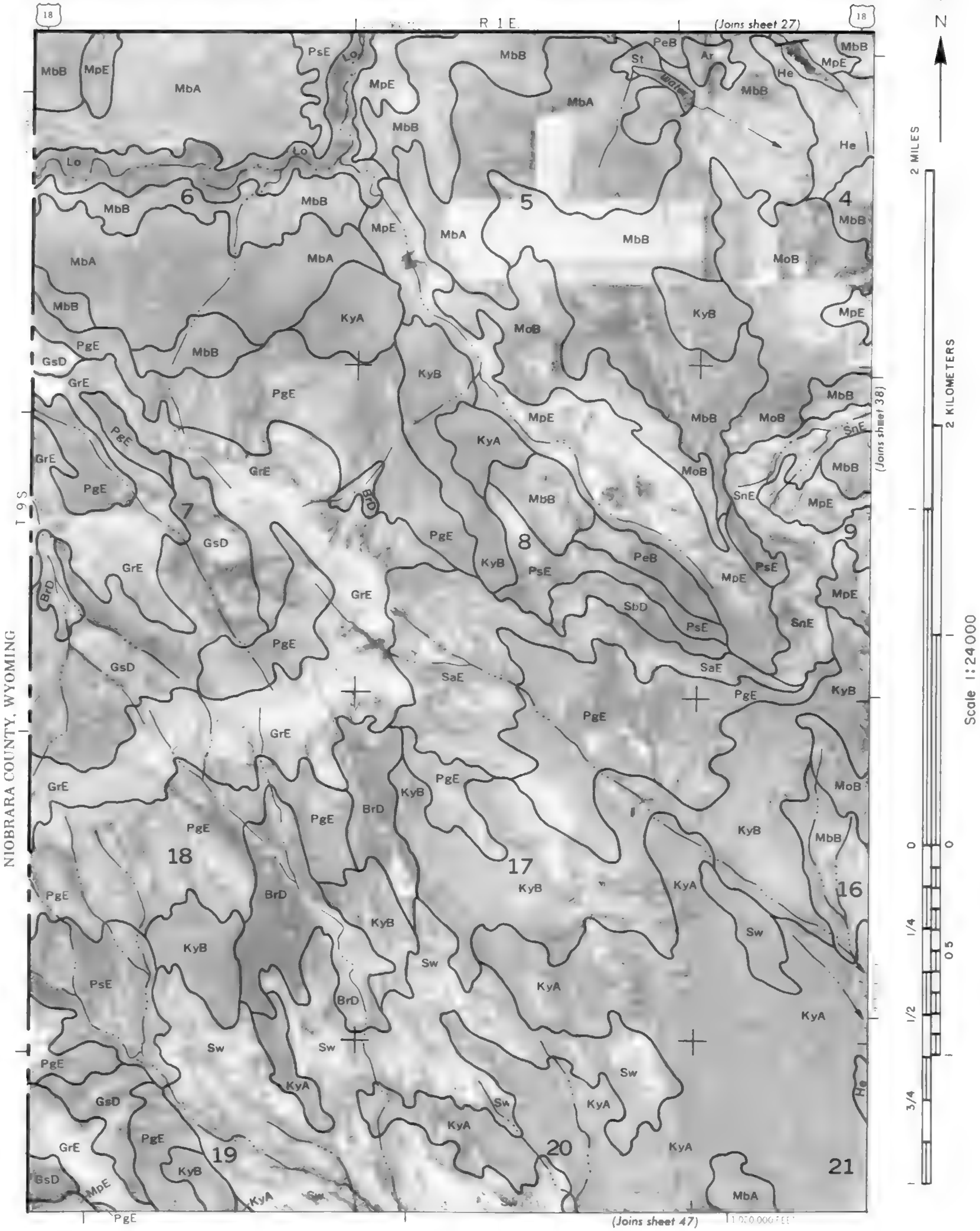

33
R 6 E.
(Joins sheet 23)
(Joins sheet 34)
(Joins sheet 44)
(Joins sheet 32)
T 8 S.
BLACK
HILLS
NATIONAL
FOREST
ANGOSTURA RESERVOIR
CHEYENNE RIVER
Horse Camp Draw
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5

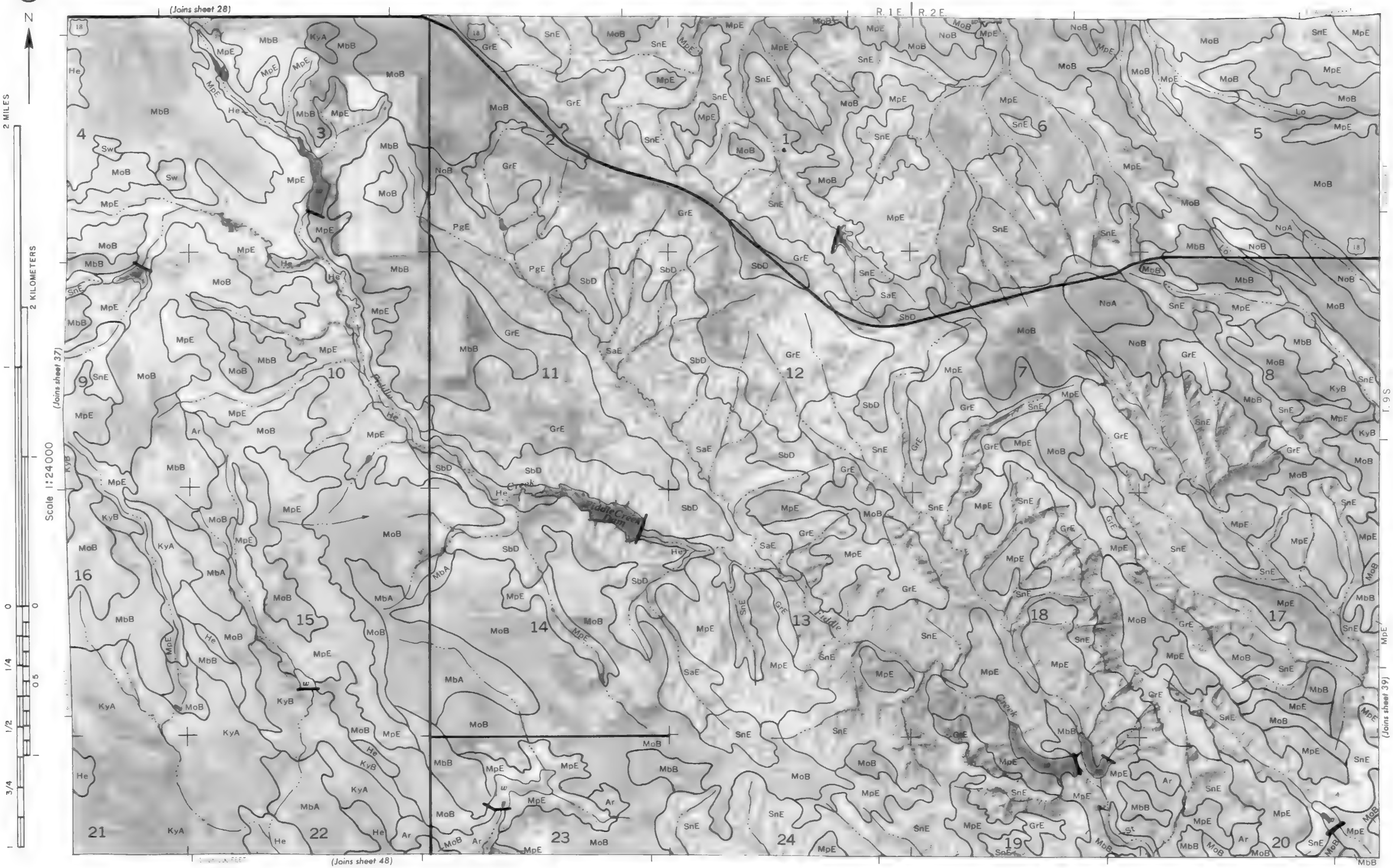

34
R 6 E | R 7 E
(Joins sheet 24)
N
2 MILES
2 KILOMETERS
Scale 1:24 000
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 44)
(Joins 45)
T 8 S
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
Slate
Spring
Draw
Sand Cr

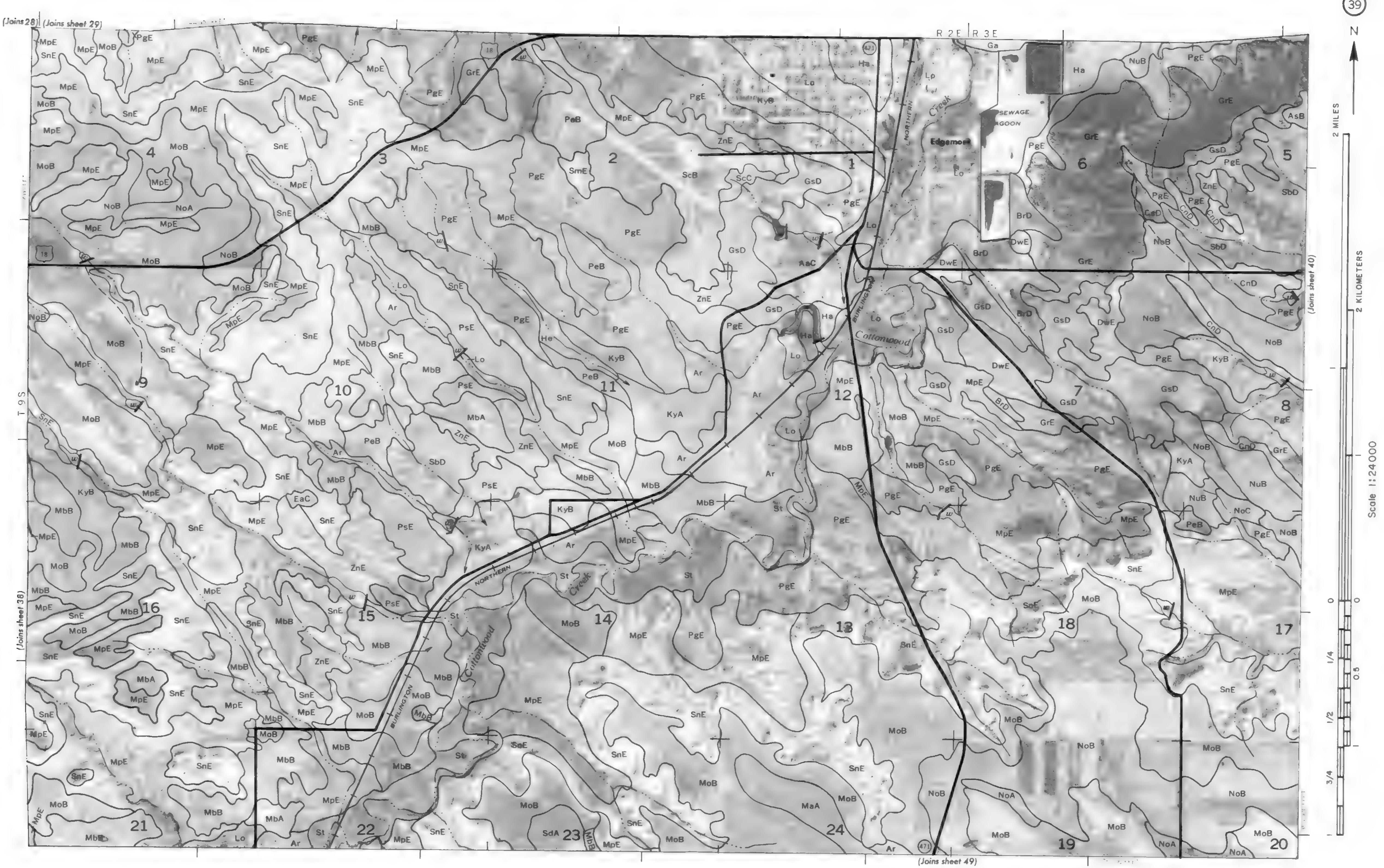

35
N
R 7 E
R 8 E
T 8 S
(Joins sheet 25)
(Joins sheet 36)
(Joins sheet 34)
(Joins sheet 45)
(Joins sheet 46)
Smithwick
Sand Creek
CHICAGO NORTHWESTERN
water
2 MILES
2 KILOMETERS
Scale 1:24 000
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
PsE
PeB
He
WpC
DaC
DaB
VaE
AsB
Ar
Ga
Lo
KyB
KyA
NuB
NuC
Sw
NoB
Bb
Ha
JaB

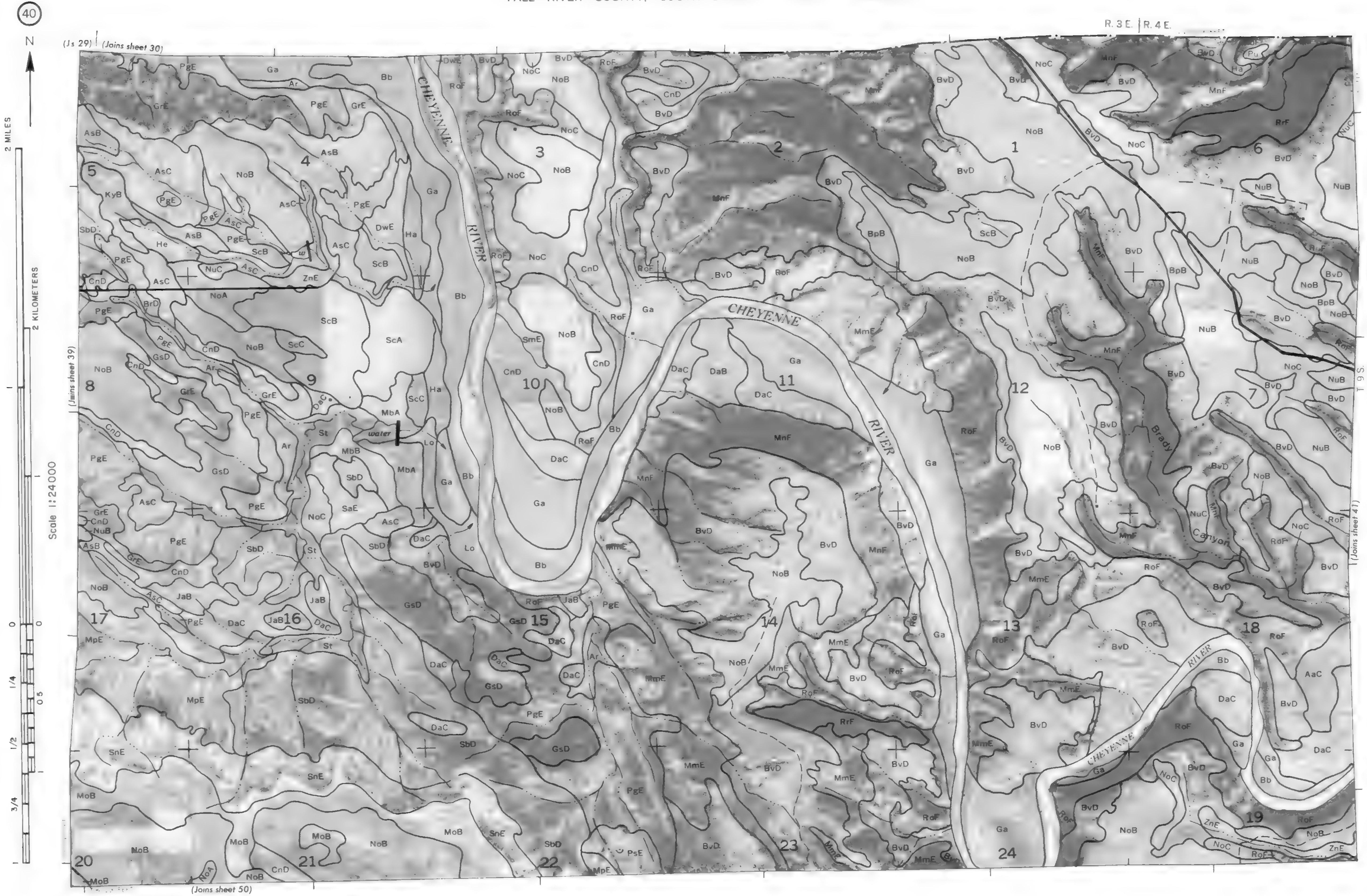

36
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0
0.5
(Joins sheet 26)
R. 8 E. | R. 9 E.
(Joins sheet 35)
T. 8 S.
(Joins inset, sheet 17)
(Joins sheet 46)
(Joins inset, sheet 27)
14
13
18
17
16
15
23
24
19
20
21
22
26
25
30
29
28
27
35
36
31
32
33
34
water
PsE
PeB
WpC
He
KyB
KyA
Lo
ZnE
NuB
St
Sw


R 9 E
(Joins inset, sheet 27)
SHANNON COUNTY
(Joins sheet 56)
(Joins inset sheet 47)
T. 9 S.
T. 10 S.
North Fork Blacktail
23
24
25
26
35
36
1
2


R 1 E
(Joins sheet 27)
(Joins sheet 38)
(Joins sheet 47)
NIOBRARA COUNTY, WYOMING
T 9 S
4
5
6
7
8
9
16
17
18
19
20
21
N
2 MILES
2 KILOMETERS
Scale 1:24 000

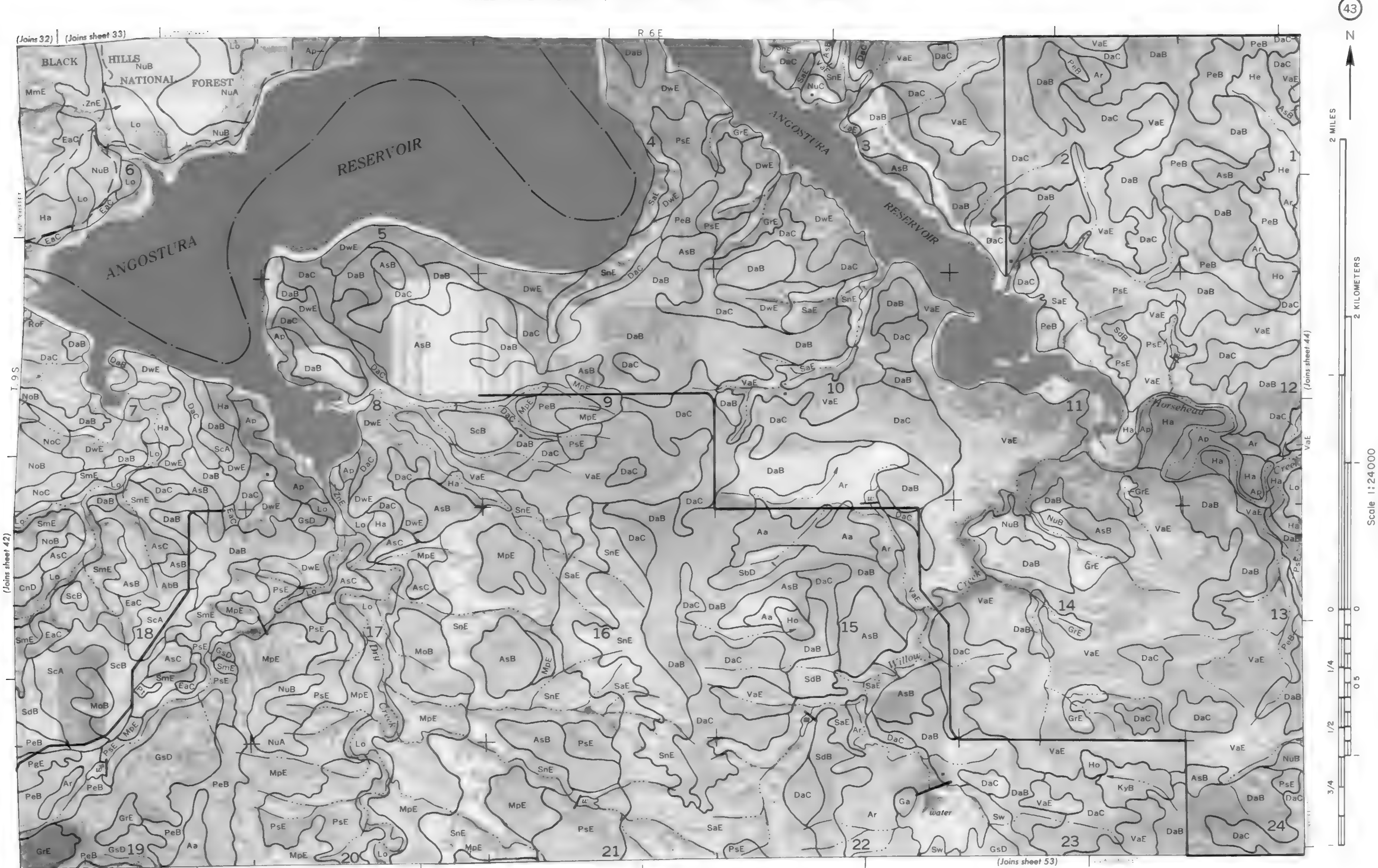

38
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0
0.5
(Joins sheet 28)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 48)
R.1 E.
R.2 E.
T.9 S.
Fiddle Creek Dam
Fiddle Creek
18

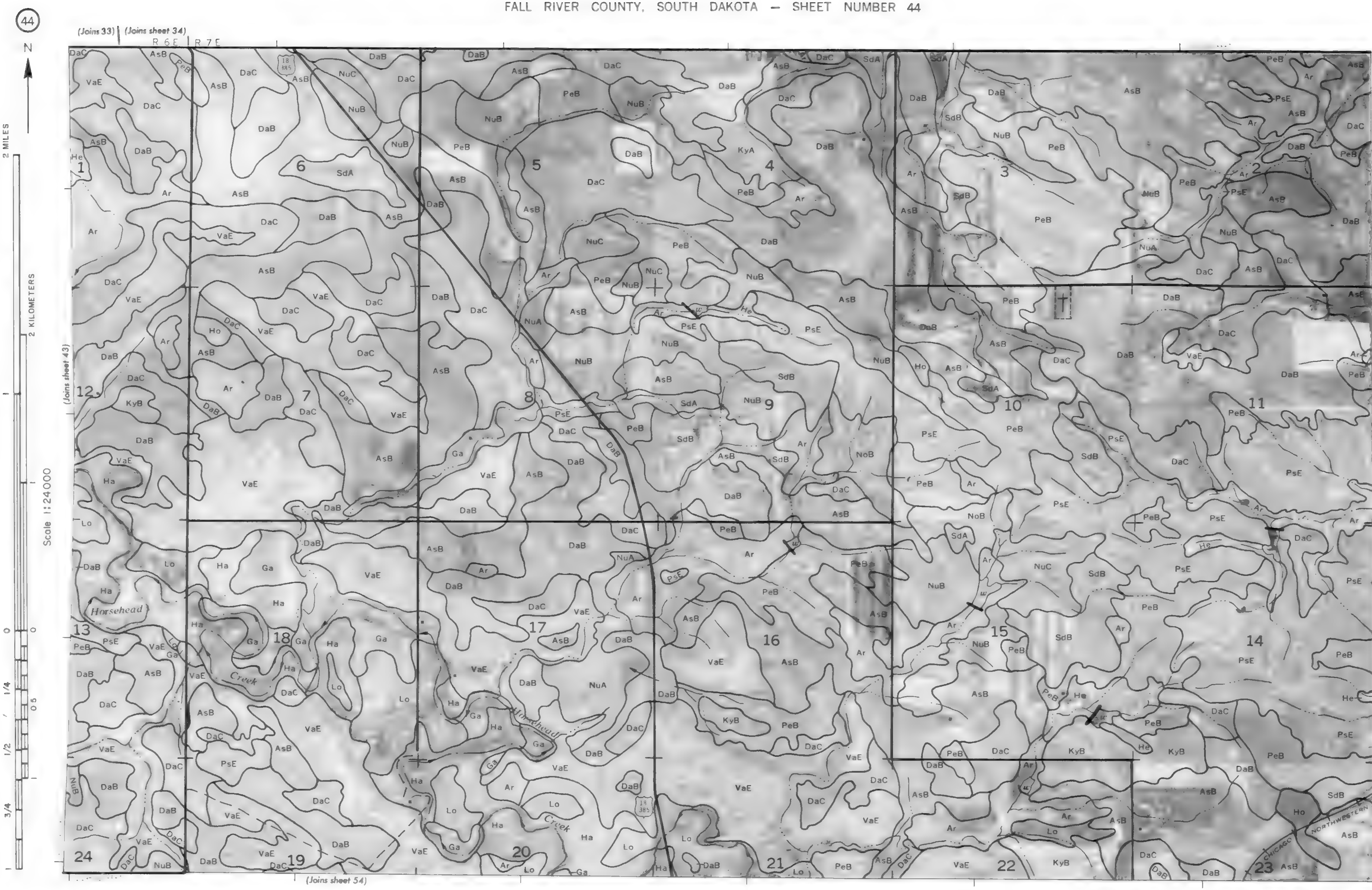

39
(Joins 28)
(Joins sheet 29)
R 2 E
R 3 E
Edgemont
SEWAGE LAGOON
Creek
Cottonwood
Creek
Cottonwood
BURLINGTON
NORTHERN
NORTHERN
BURLINGTON
T 9 S
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 49)
18
471
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5

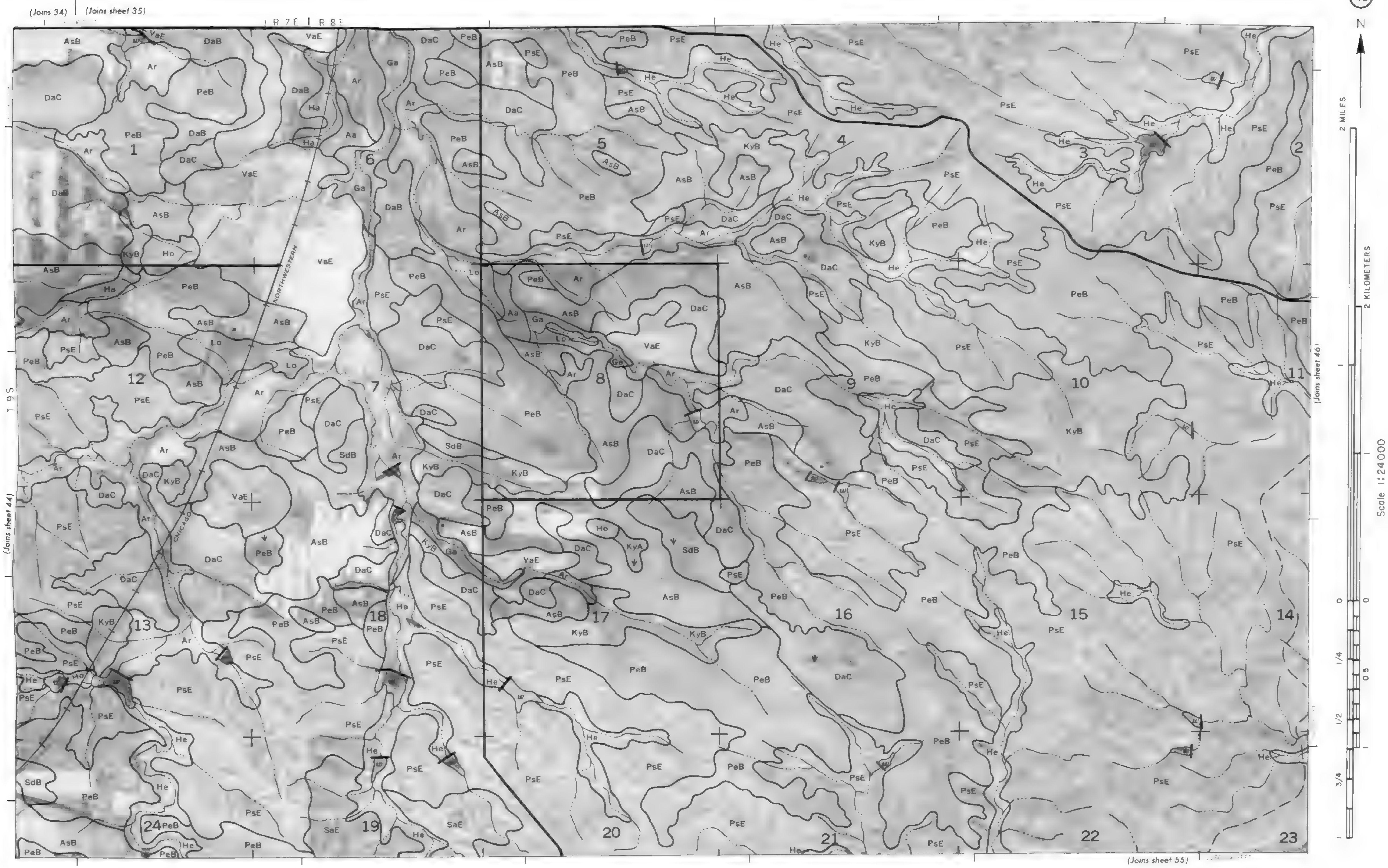

40
N
2 MILES
2 KILOMETERS
Scale 1:24000
(Js 29)
(Joins sheet 30)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 50)
R. 3 E. | R. 4 E.
T. 9 S.
CHEYENNE RIVER
CHEYENNE RIVER
CHEYENNE RIVER
Brady Canyon
water

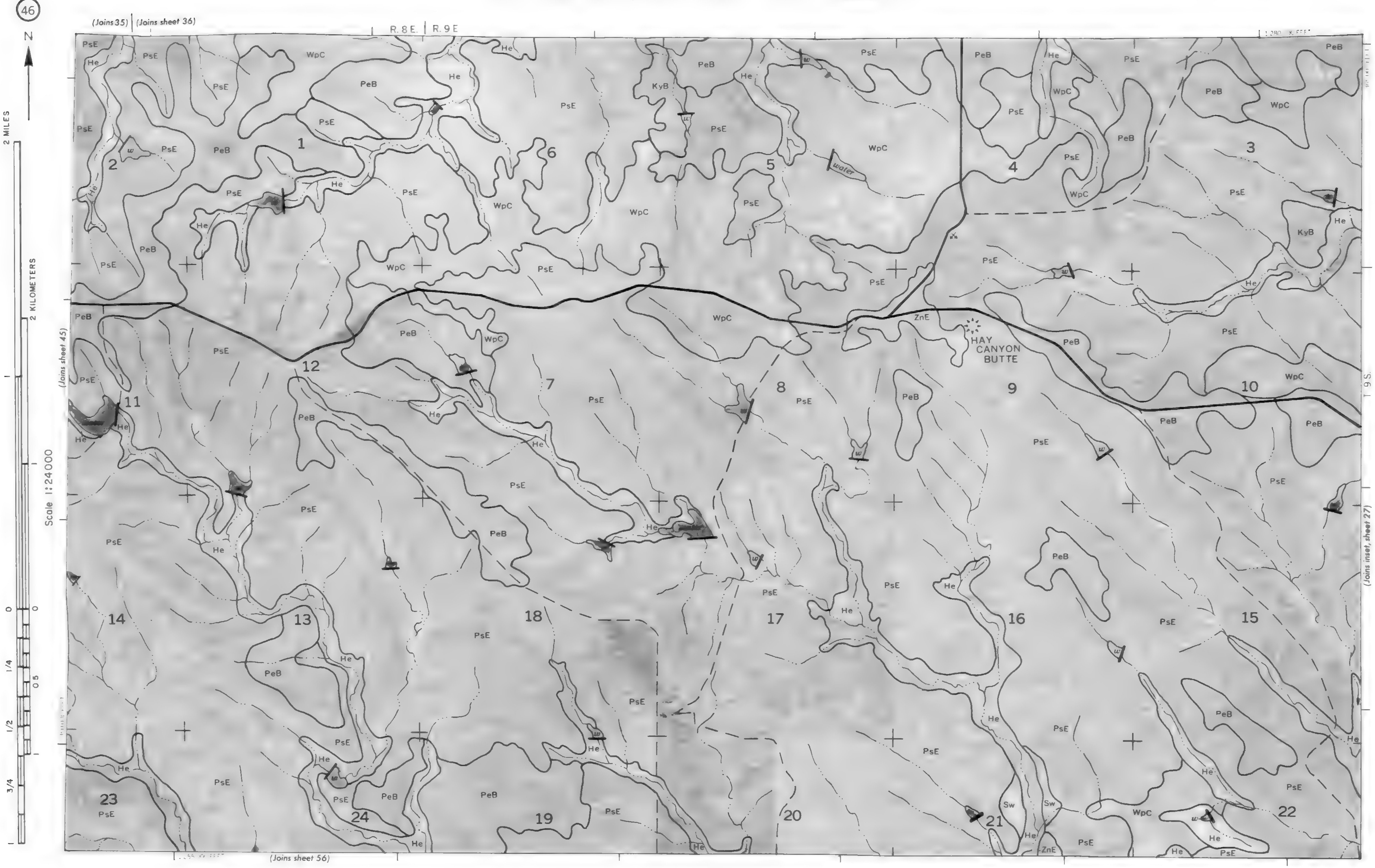

41
(Joins 30)
(Joins sheet 31)
1 110 000 FEET
R. 4 E.
R. 5 E.
N
BLACK
HILLS
NATIONAL
FOREST
CHILSON
CANYON
CHEYENNE
RIVER
Coffee
Flats
Flat
Sorghum
Stage
Hill
Hat
Creek
T. 9 S.
(Joins sheet 42)
(Joins sheet 41)
(Joins sheet 51)
2 MILES
2 KILOMETERS
Scale 1:24000
1/4
1/2
3/4
0.5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

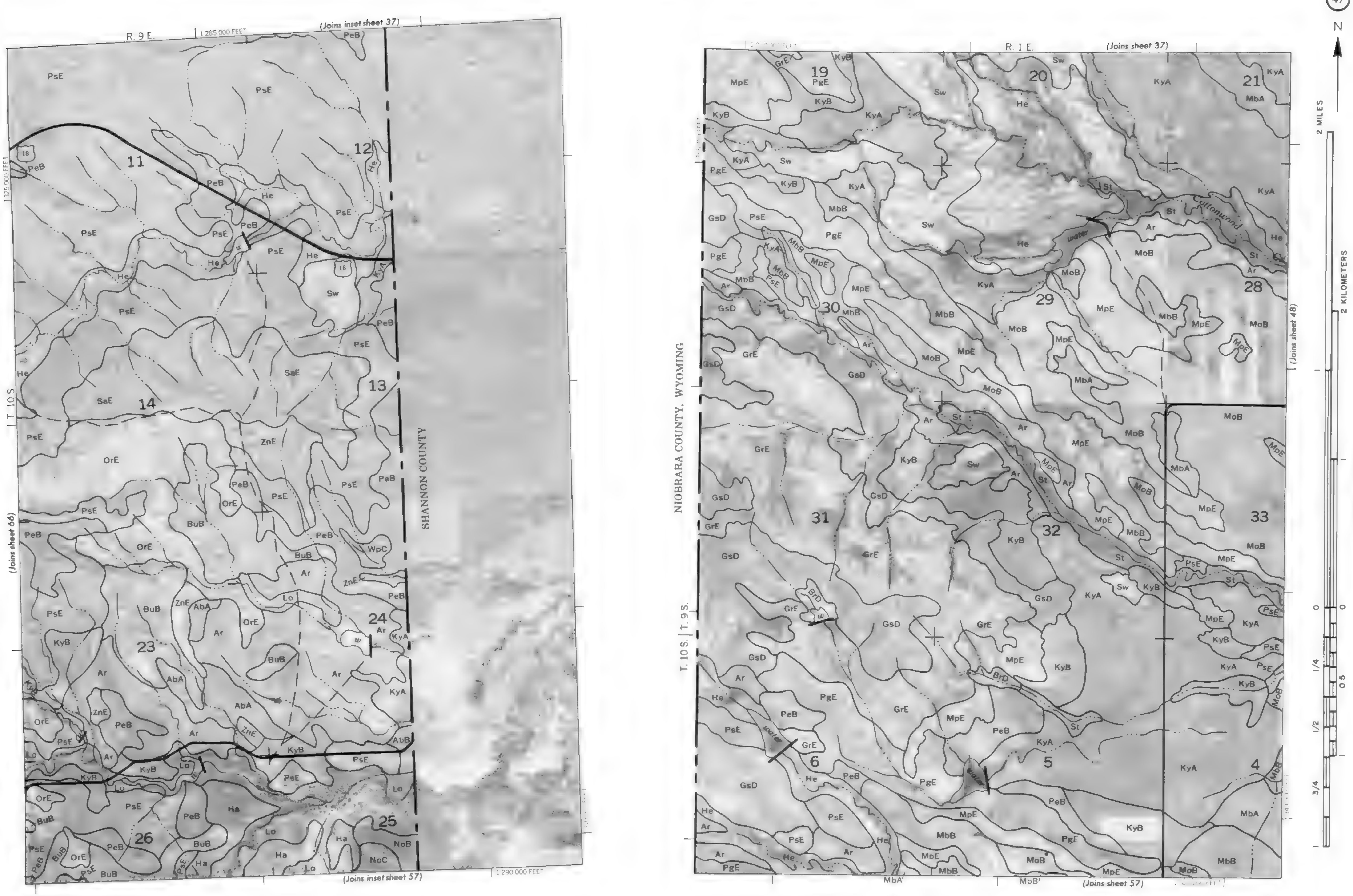

(Joins 31)
(Joins sheet 32)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 52)
N
R 5 E.
BLACK HILLS NATIONAL FOREST
ANGOSTURA RESERVOIR
CHEYENNE RIVER
Coffee Flats
Tepee Mountain
Jackson Narrows
Little Tepee Creek
Tepee Creek
Scale 1:24000
2 MILES
2 KILOMETERS

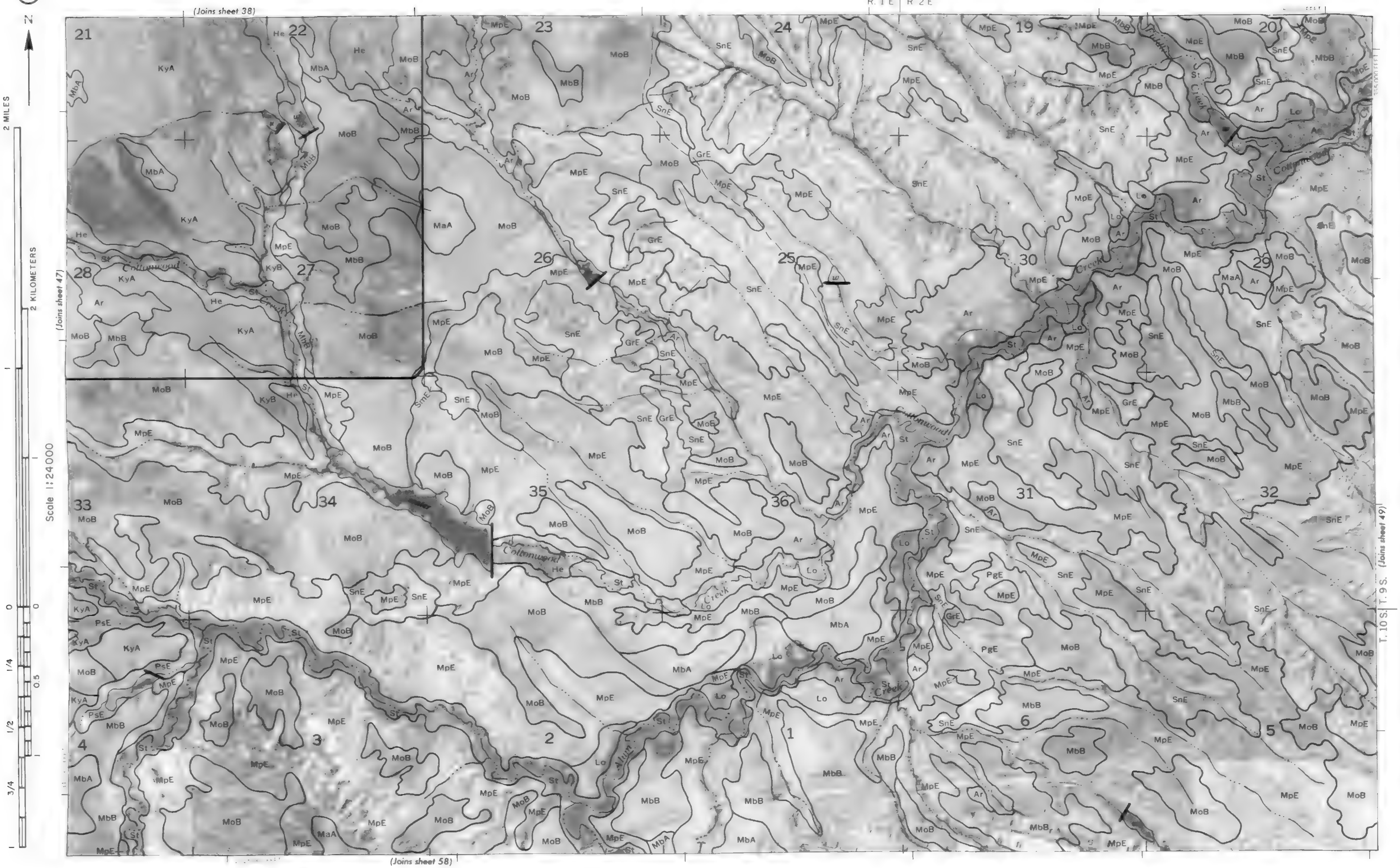

43
(Joins 32)
(Joins sheet 33)
R. 6 E.
T. 9 S.
BLACK HILLS NATIONAL FOREST
ANGOSTURA RESERVOIR
ANGOSTURA RESERVOIR
Horsehead Creek
Willow Creek
Dry Creek
water
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 53)
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5

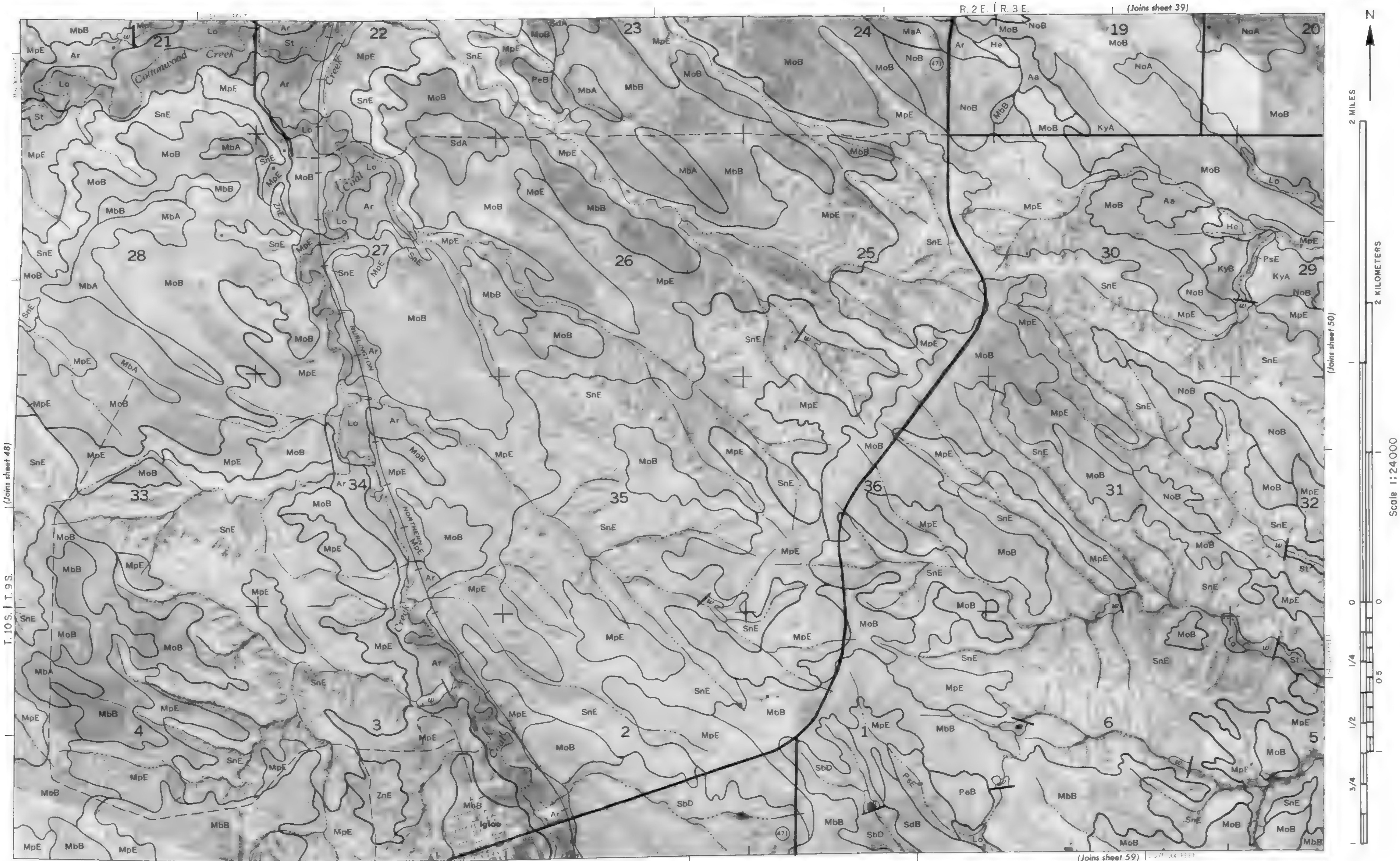

44
(Joins 33)
(Joins sheet 34)
R 6 E
R 7 E
N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 54)
T 9 S
Horsehead
Creek
Horsehead
Creek
CHICAGO
NORTHWESTERN
18
385
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24


(Joins 34)
(Joins sheet 35)
R 7 E
R 8 E
T 9 S
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 55)
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
CHICAGO
NORTHWESTERN
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
AsB
VaE
DaB
DaC
Ar
PeB
Ha
Aa
Ga
PsE
He
KyB
KyA
Ho
Lo
SdB
SaE


46
N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins 35)
(Joins sheet 36)
R.8E.
R.9E
(Joins sheet 45)
(Joins sheet 56)
(Joins inset, sheet 27)
T.9S.
HAY CANYON BUTTE
water
PsE
PeB
He
WpC
KyB
ZnE
Sw
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

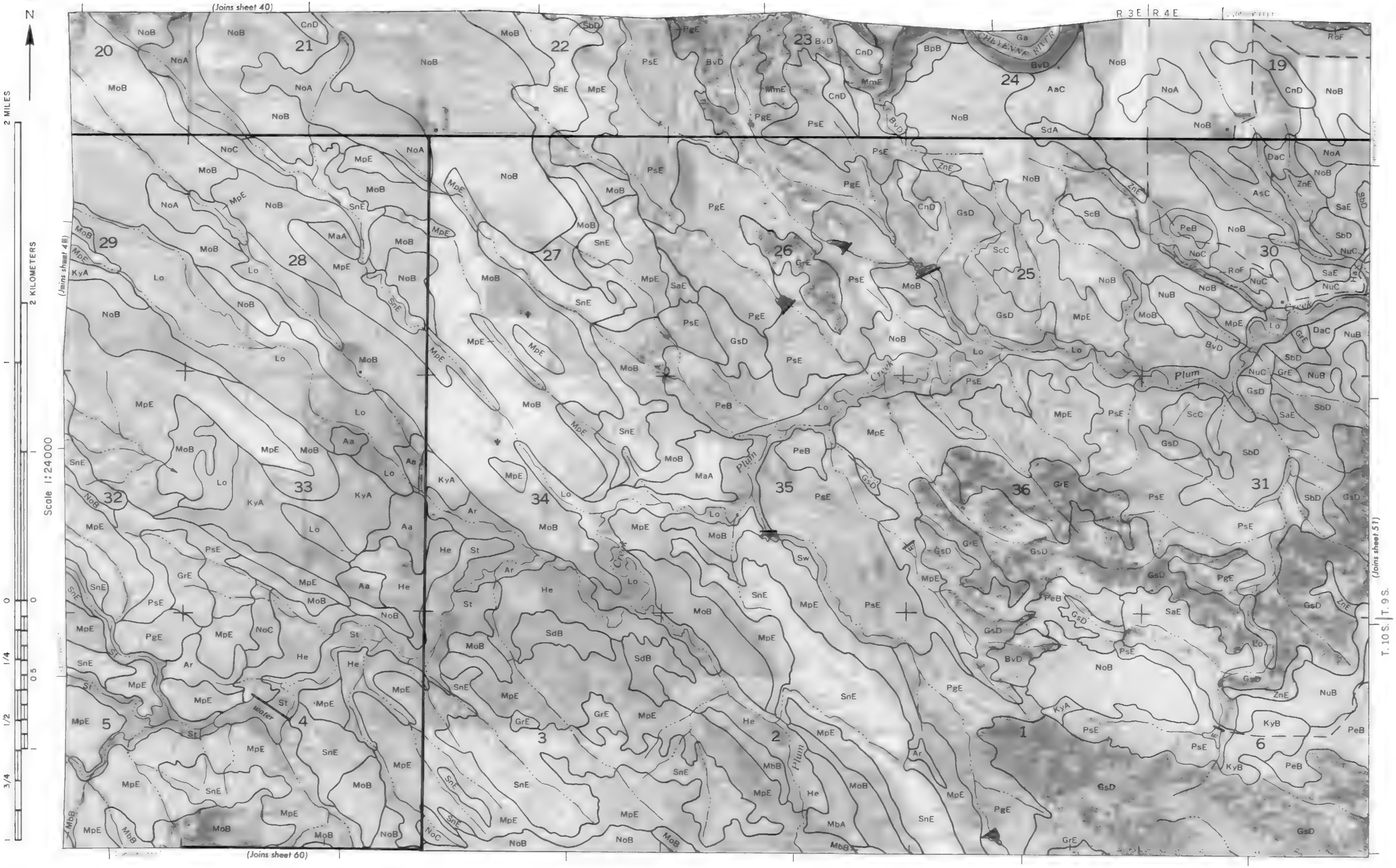

47
N
R. 9 E.
1 285 000 FEET
(Joins inset sheet 37)
(Joins inset sheet 66)
SHANNON COUNTY
T. 10 S.
(Joins inset sheet 57)
1 290 000 FEET
R. 1 E.
(Joins sheet 37)
(Joins sheet 48)
(Joins sheet 57)
NIOBRARA COUNTY, WYOMING
T. 10 S. | T. 9 S.
Cottonwood
water
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5

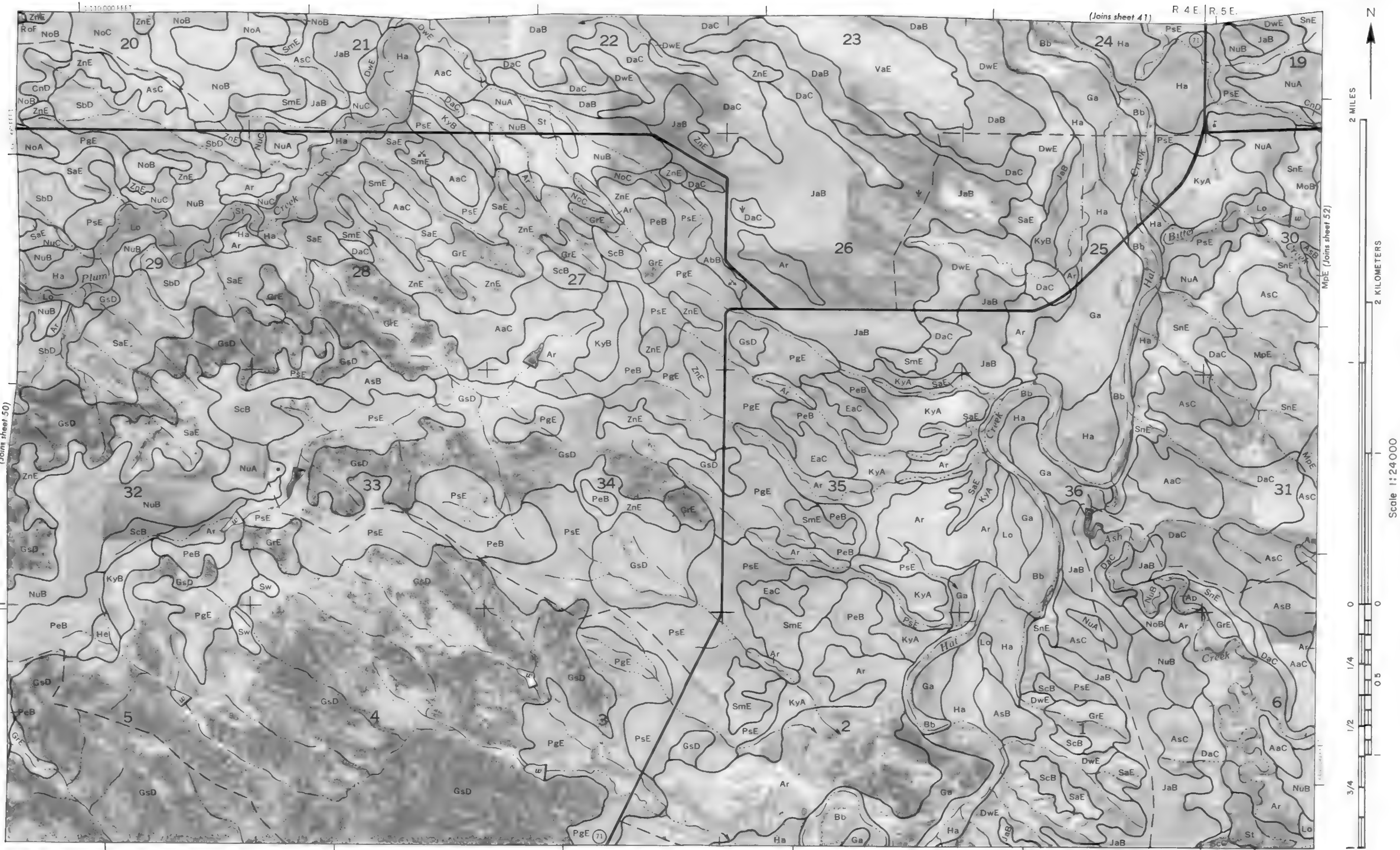

(Joins sheet 38)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 58)
R. 1 E.
R. 2 E.
T. 9 S.
T. 10 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5
Cottonwood
Creek
Alum
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32
4
3
2
1
6
5
KyA
KyB
MbA
MbB
He
MoB
MpE
SnE
SmE
Ar
St
Lo
GrE
MaA
PsE
PgE

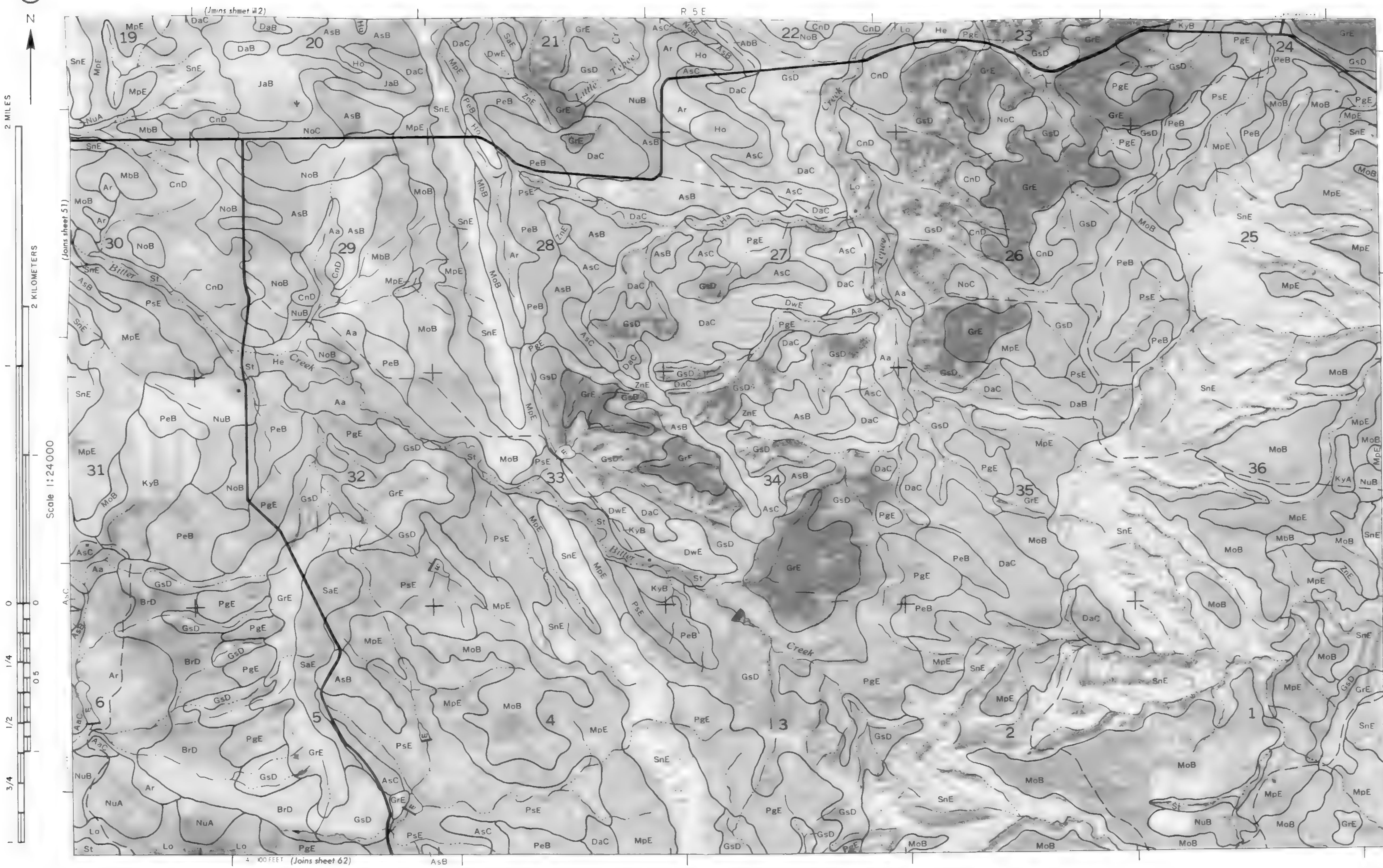


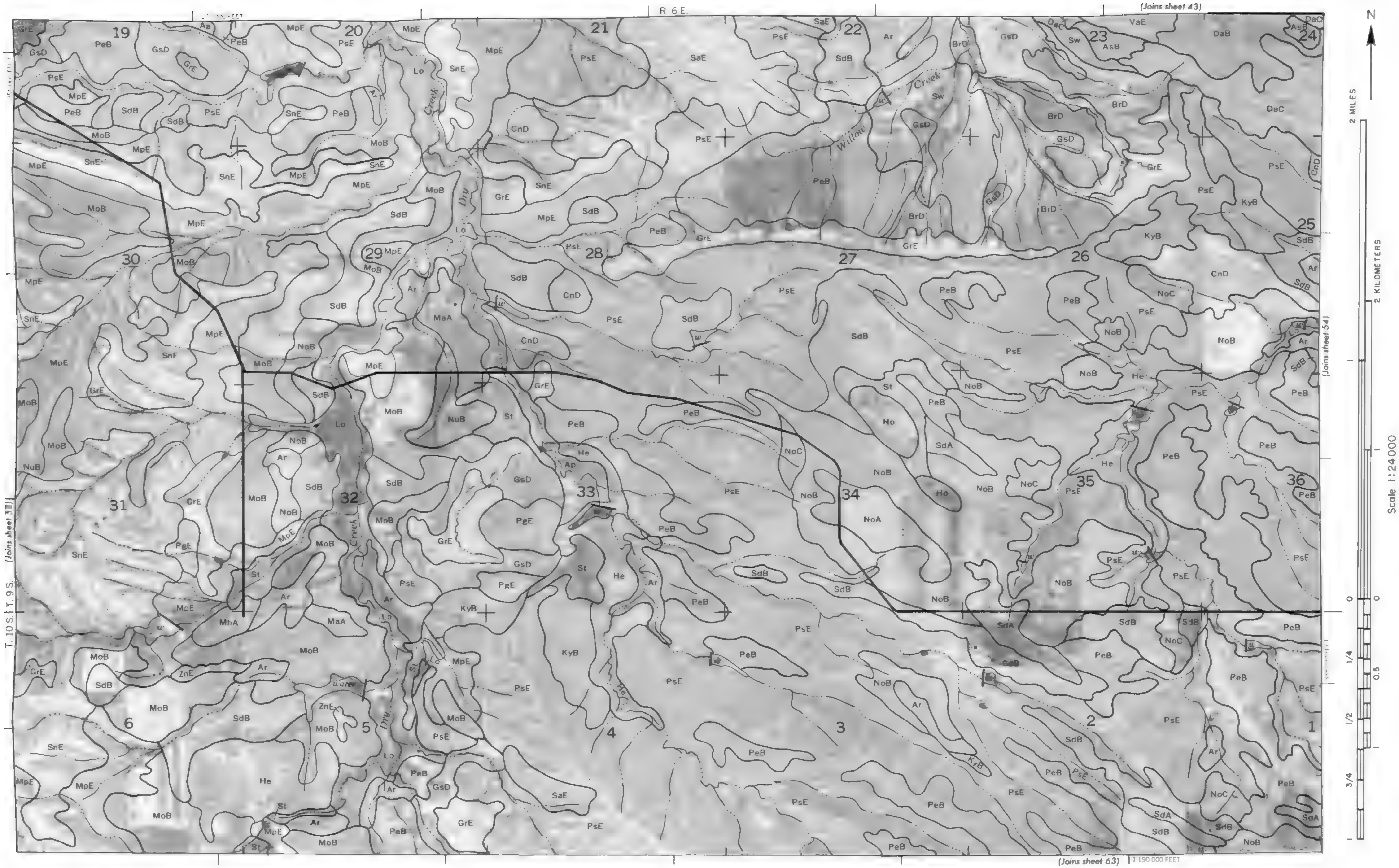
(Joins sheet 39)
R. 2 E. | R. 3 E.
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 59)
T. 10 S. | T. 9 S.
N
Cottonwood Creek
Coal Creek
BURLINGTON NORTHERN
Igloo
471
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32
4
3
2
1
6
5

FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 50

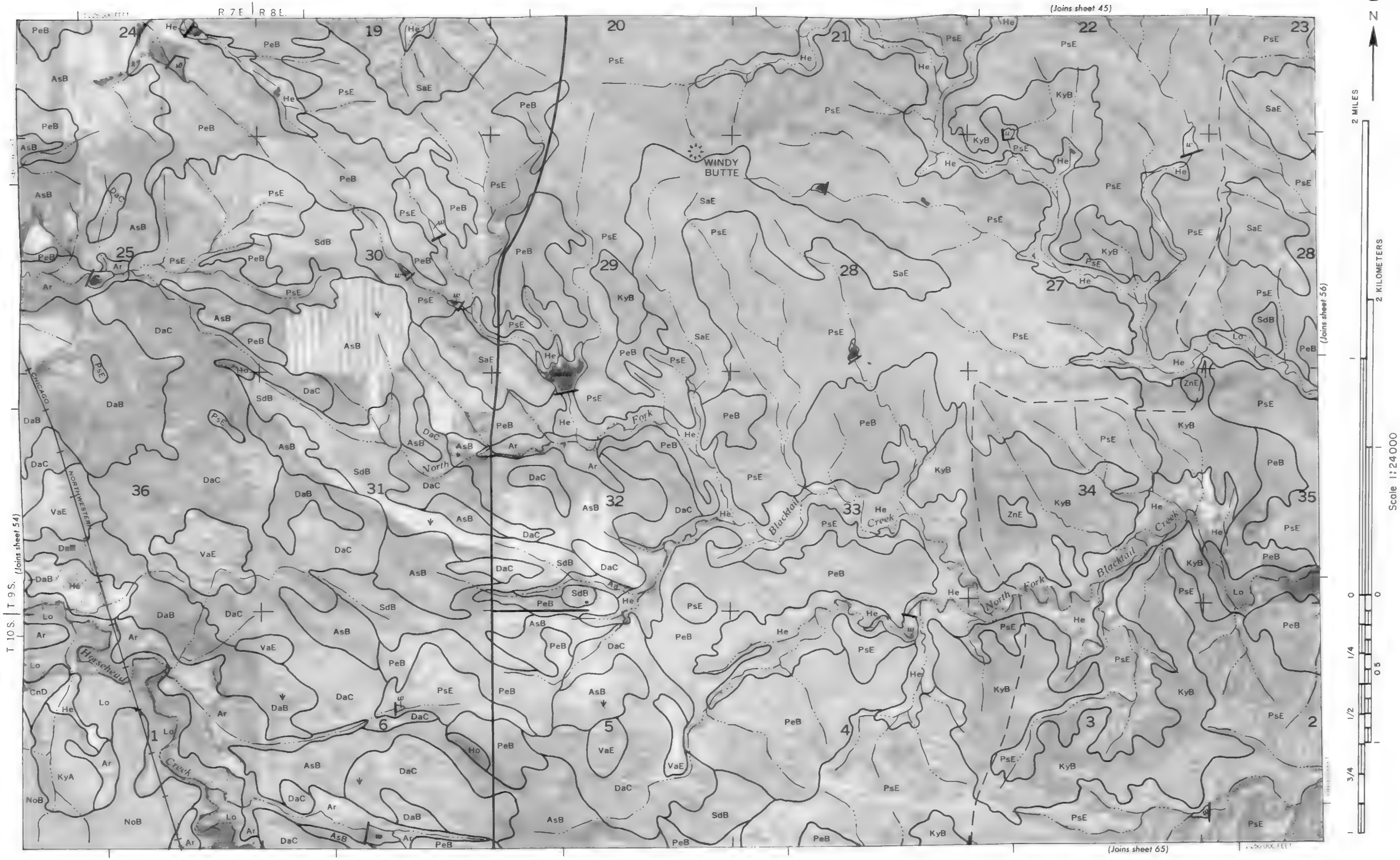


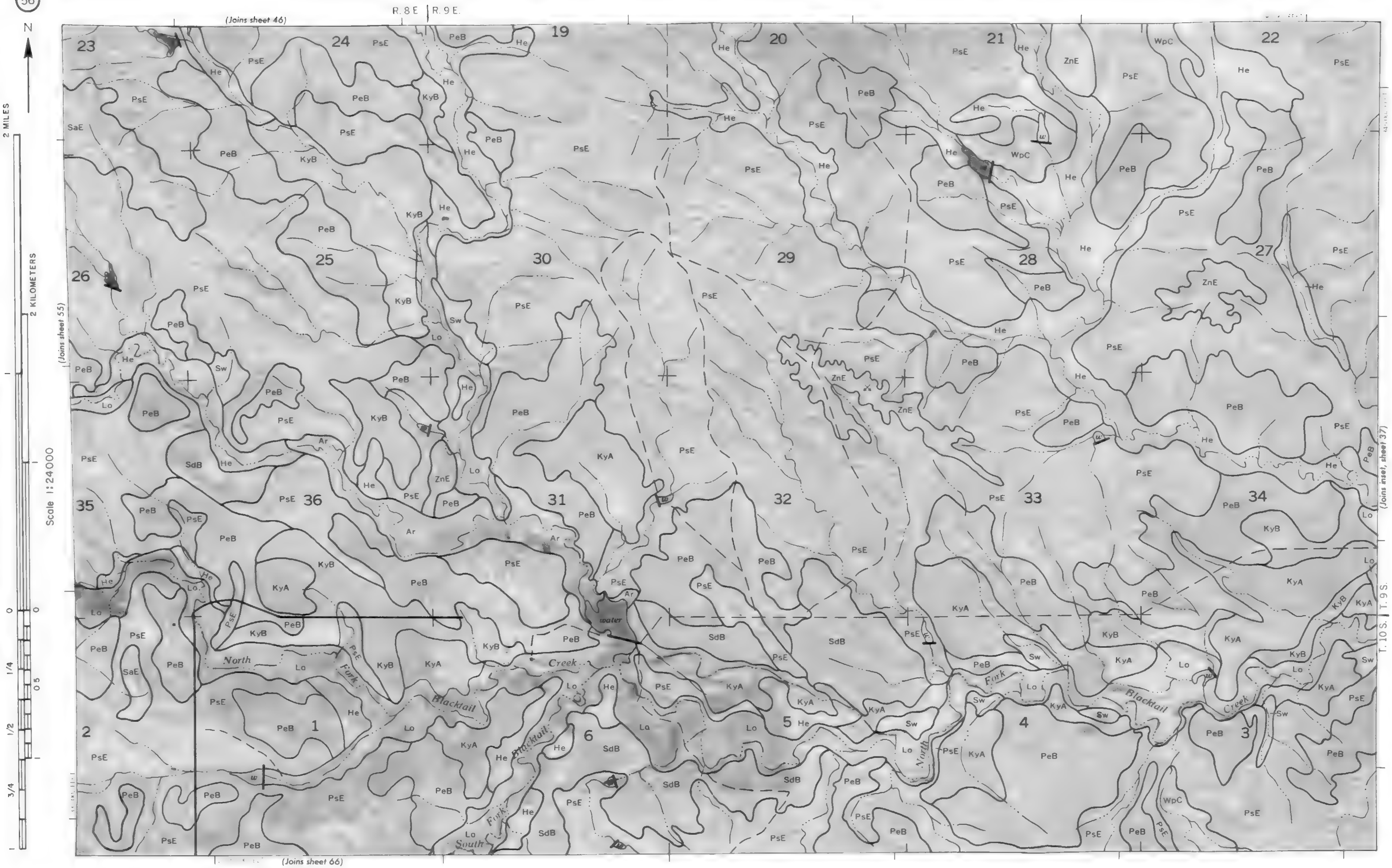

(Joins sheet 41)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 61)
R. 4 E.
R. 5 E.
T. 10 S.
T. 9 N.
N
2 MILES
2 KILOMETERS
Scale 1:24000
Plum Creek
Hat Creek
Ash Creek
Bitter Creek
71

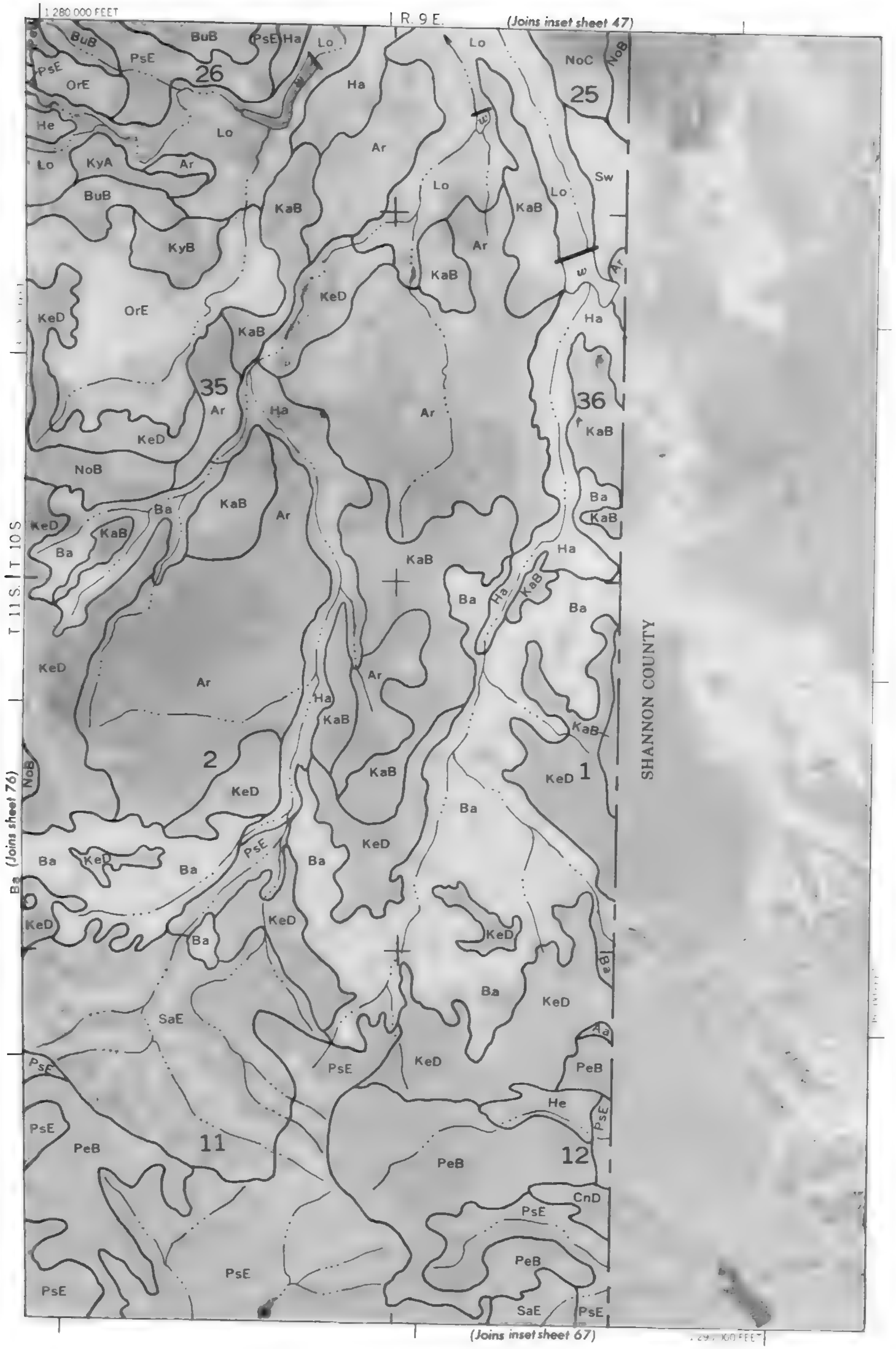

N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 42)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 62)
R 5 E
T 10 S
100 FEET
Little Tepee Cr
Tepee Creek
Bitter St
Bitter Creek
He Creek
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6

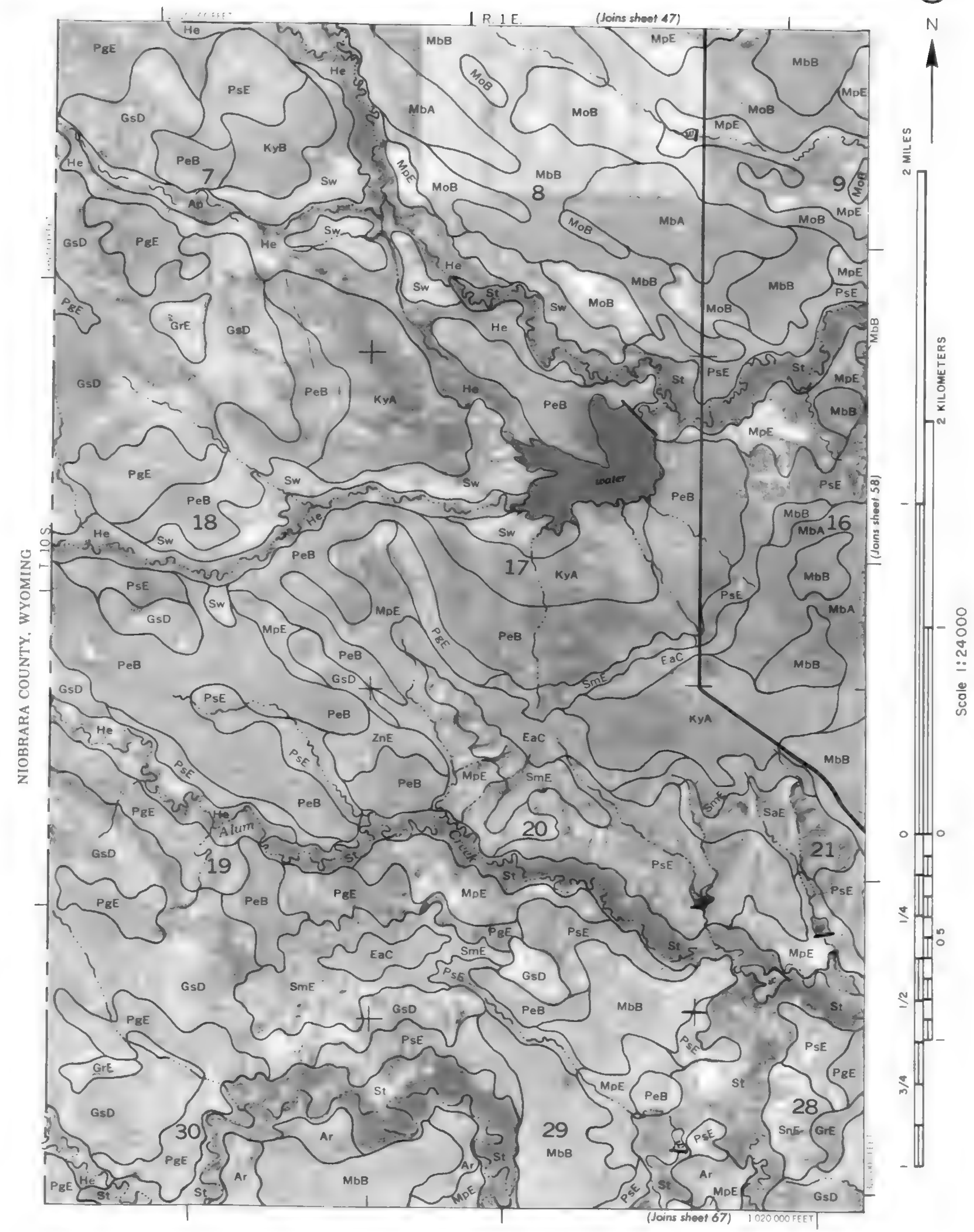

(Joins sheet 43)
R 6 E.
(Joins sheet 54)
(Joins sheet 63)
1 190 000 FEET
T. 9 S.
T. 10 S.
N
2 MILES
2 KILOMETERS
Scale 1:24 000
Willow Creek
Dry Creek
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6

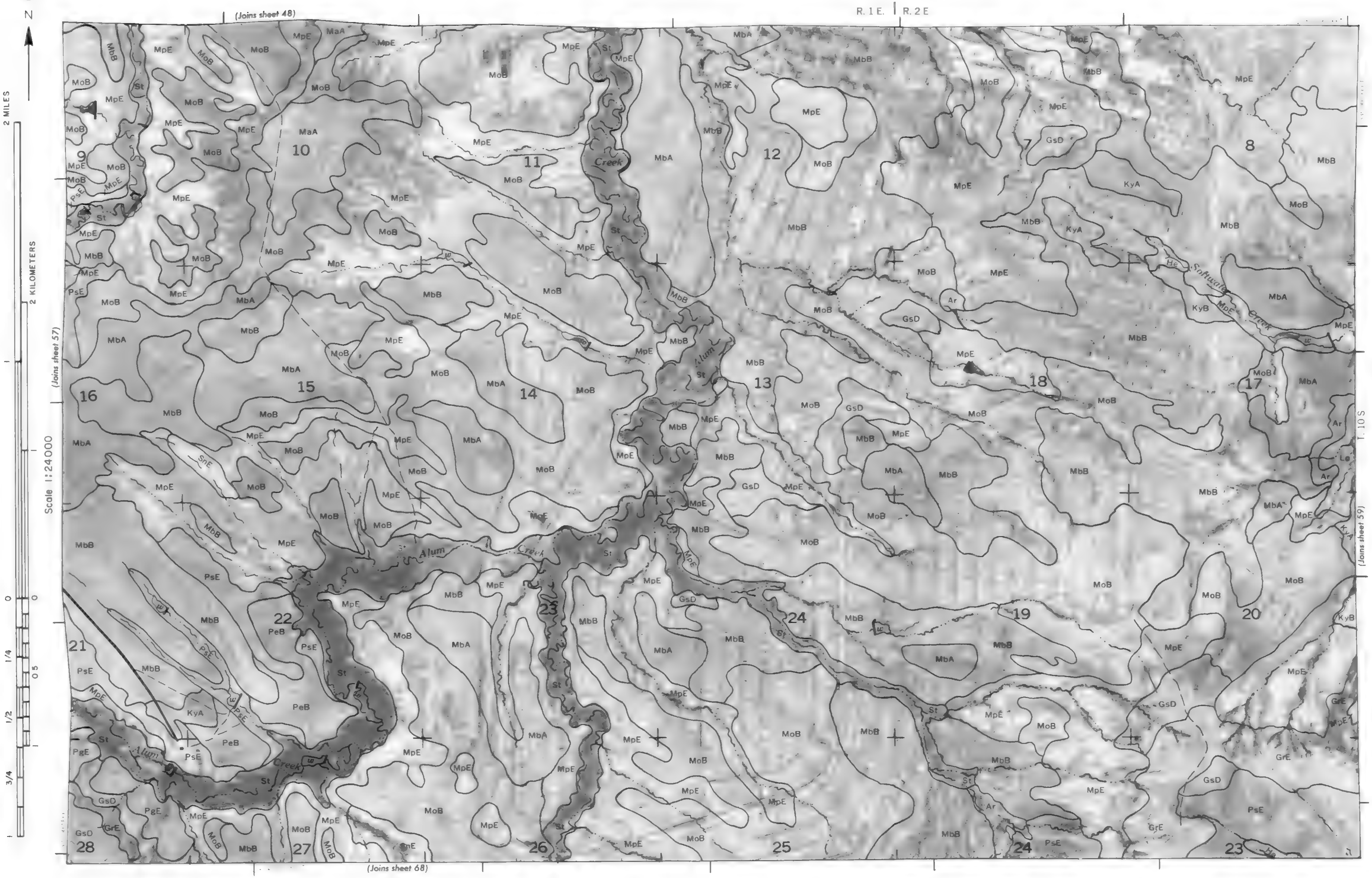
FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 54

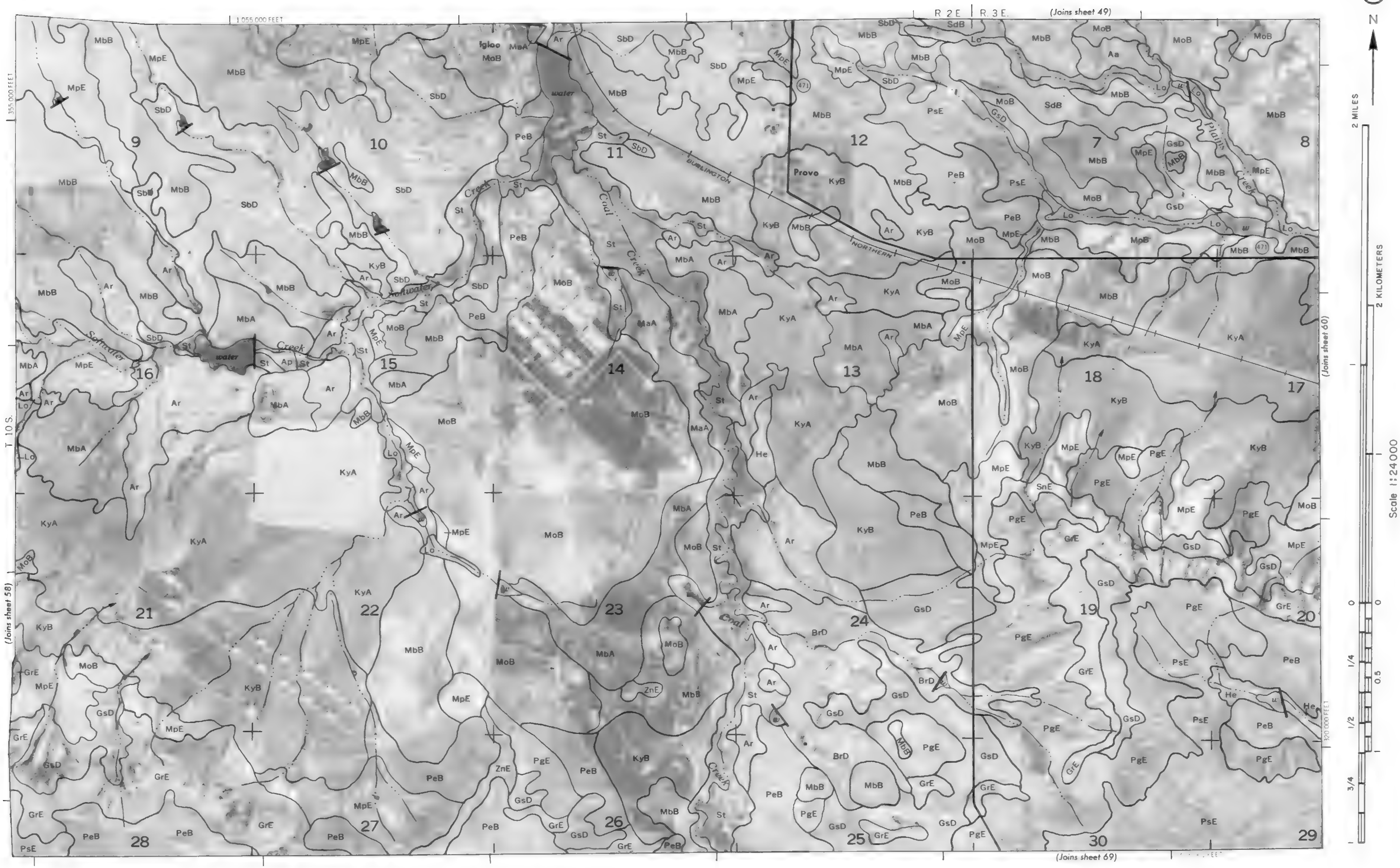

(Joins sheet 45)
(Joins sheet 56)
(Joins sheet 65)
(Joins sheet 54)
R 7 E.
R 8 E.
T 9 S.
T 10 S.
WINDY BUTTE
North Fork
Blacktail Creek
North Fork
Blacktail Creek
Horsehead Creek
CHICAGO
NORTHWESTERN
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5
1
2

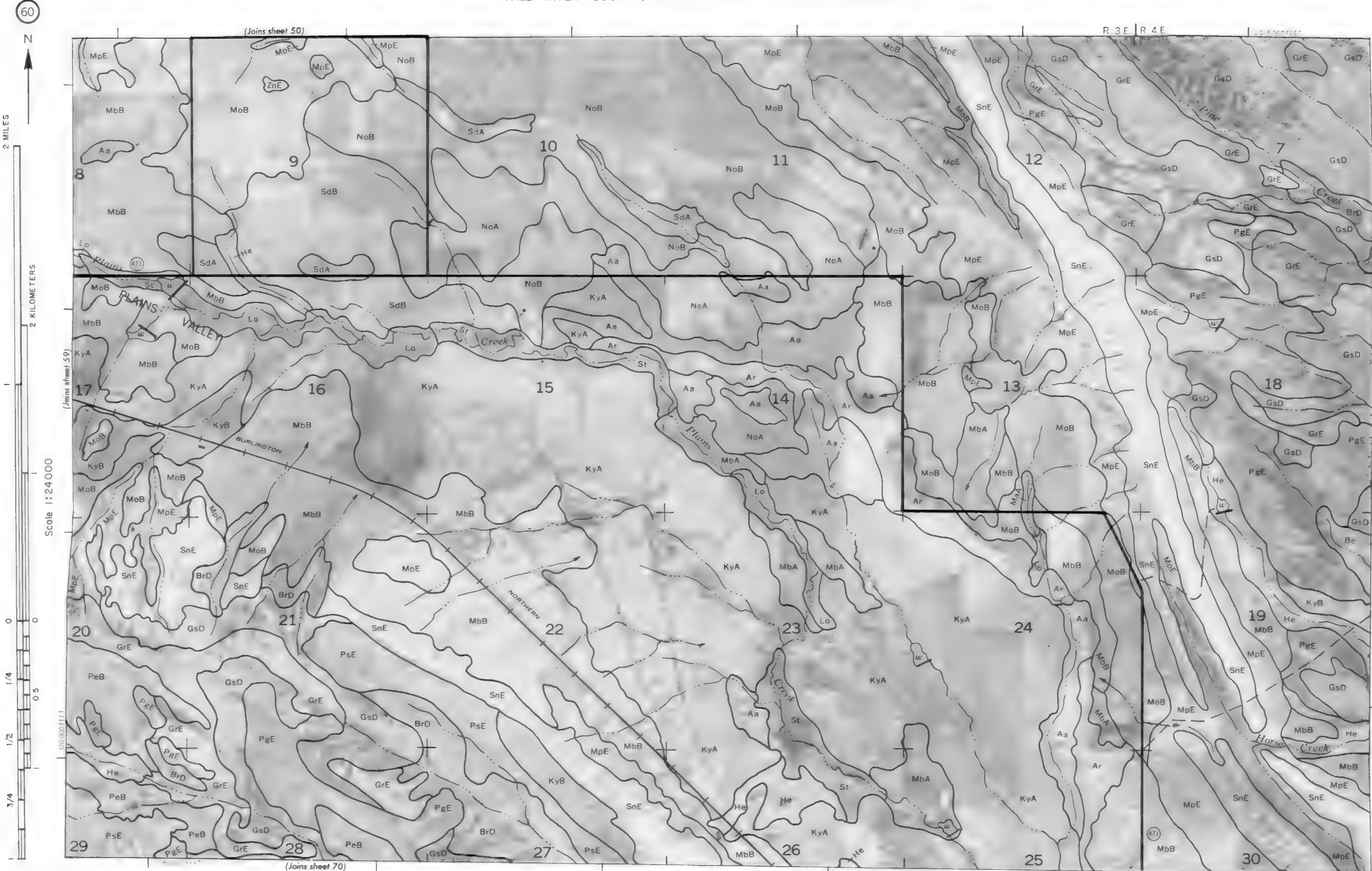

(Joins sheet 46)
R. 8 E. | R. 9 E.
(Joins sheet 55)
(Joins inset, sheet 37)
(Joins sheet 66)
T. 9 S.
T. 10 S.
N
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
0.5
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
North
Fork
Blacktail
Creek
South
water
PsE
PeB
He
KyB
KyA
SdB
ZnE
WpC
SaE
Sw
Lo
Ar

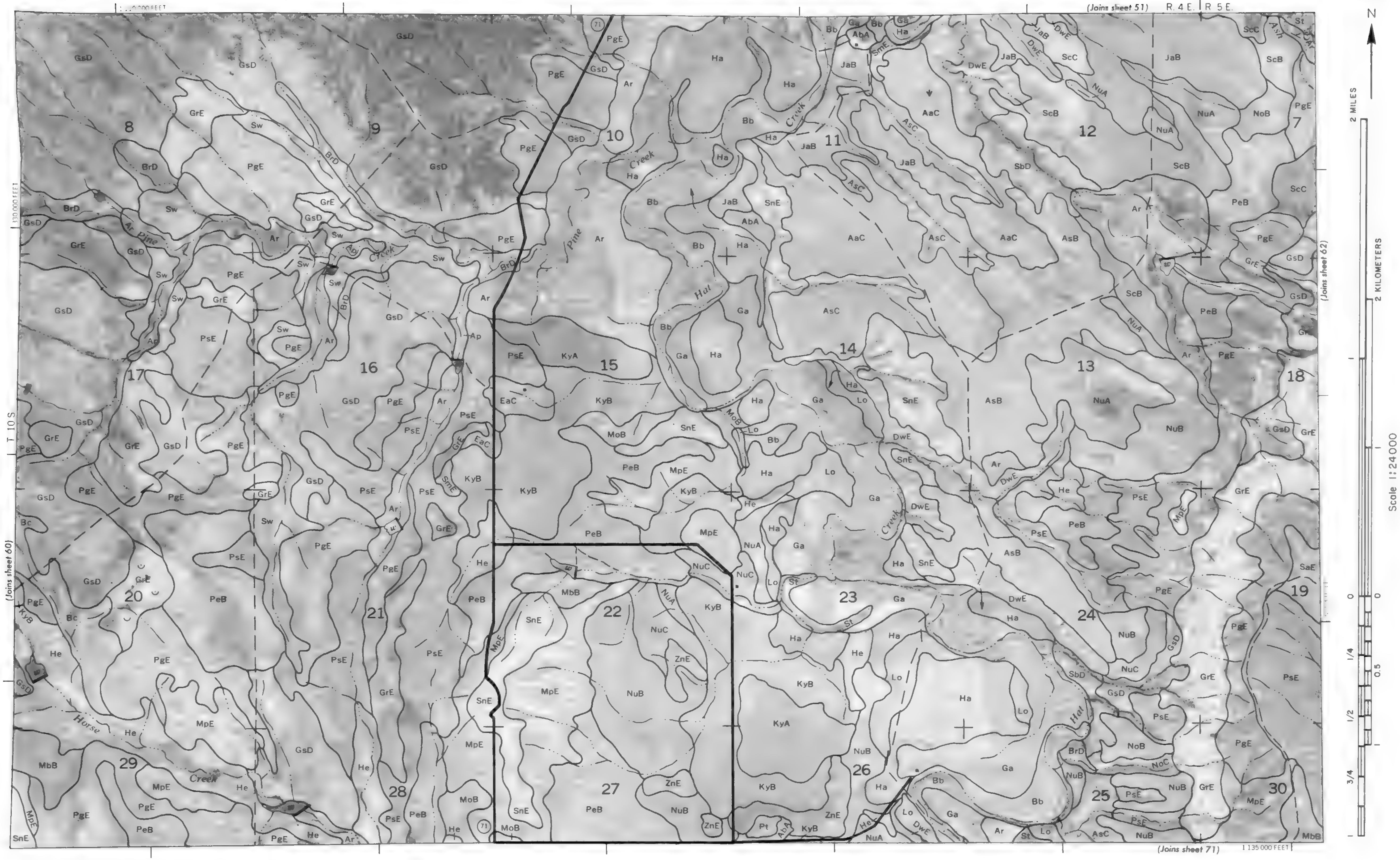

1 280 000 FEET
R. 9 E.
(Joins inset sheet 47)
T. 10 S.
T. 11 S.
(Joins sheet 76)
SHANNON COUNTY
(Joins inset sheet 67)
26
25
35
36
2
1
11
12

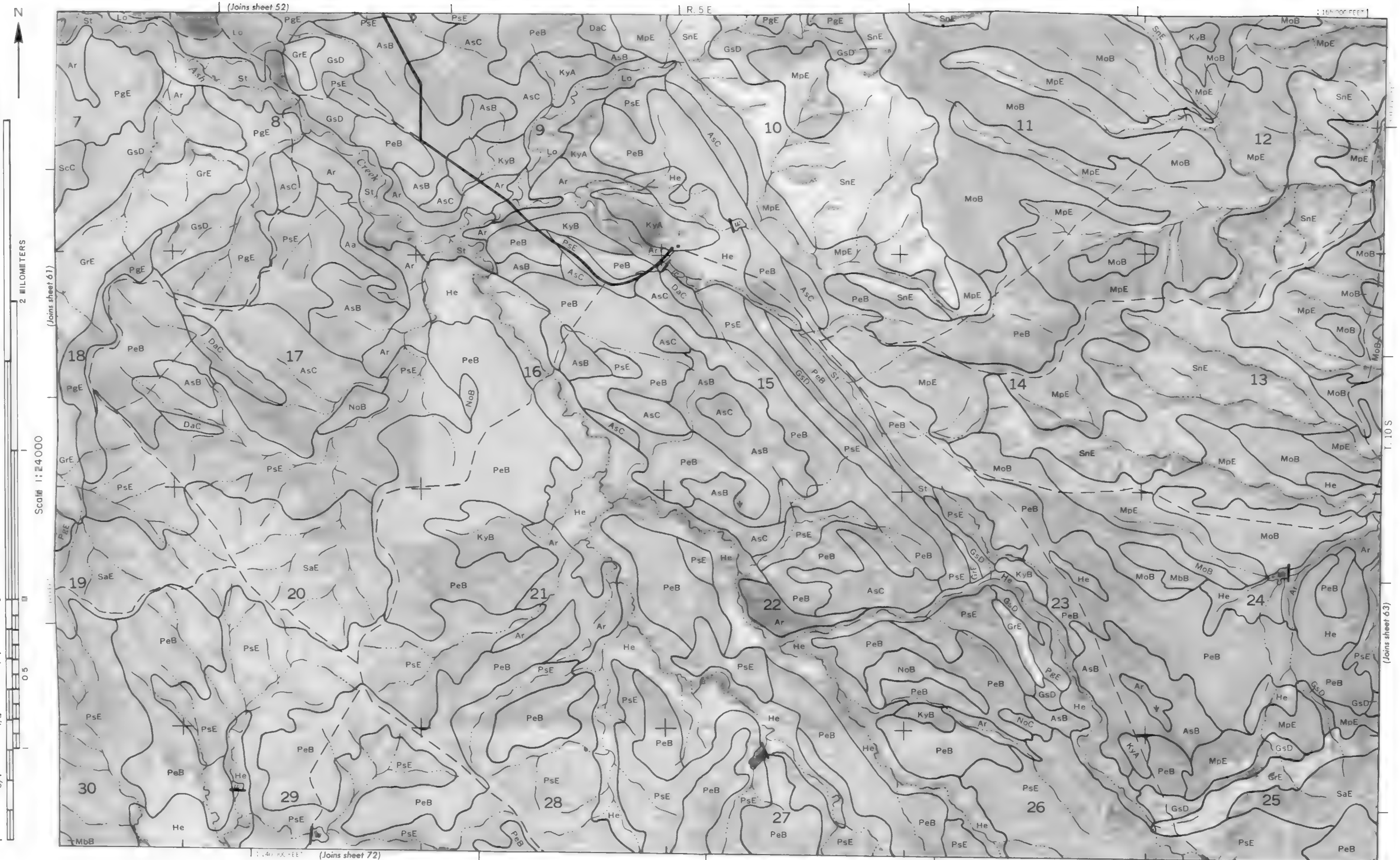

R. 1 E.
(Joins sheet 47)
T. 10 S.
NIOBRARA COUNTY, WYOMING
(Joins sheet 58)
(Joins sheet 67)
1 020 000 FEET
water
Alum Creek
7
8
9
16
17
18
19
20
21
28
29
30
N
2 MILES
2 KILOMETERS
Scale 1:24 000

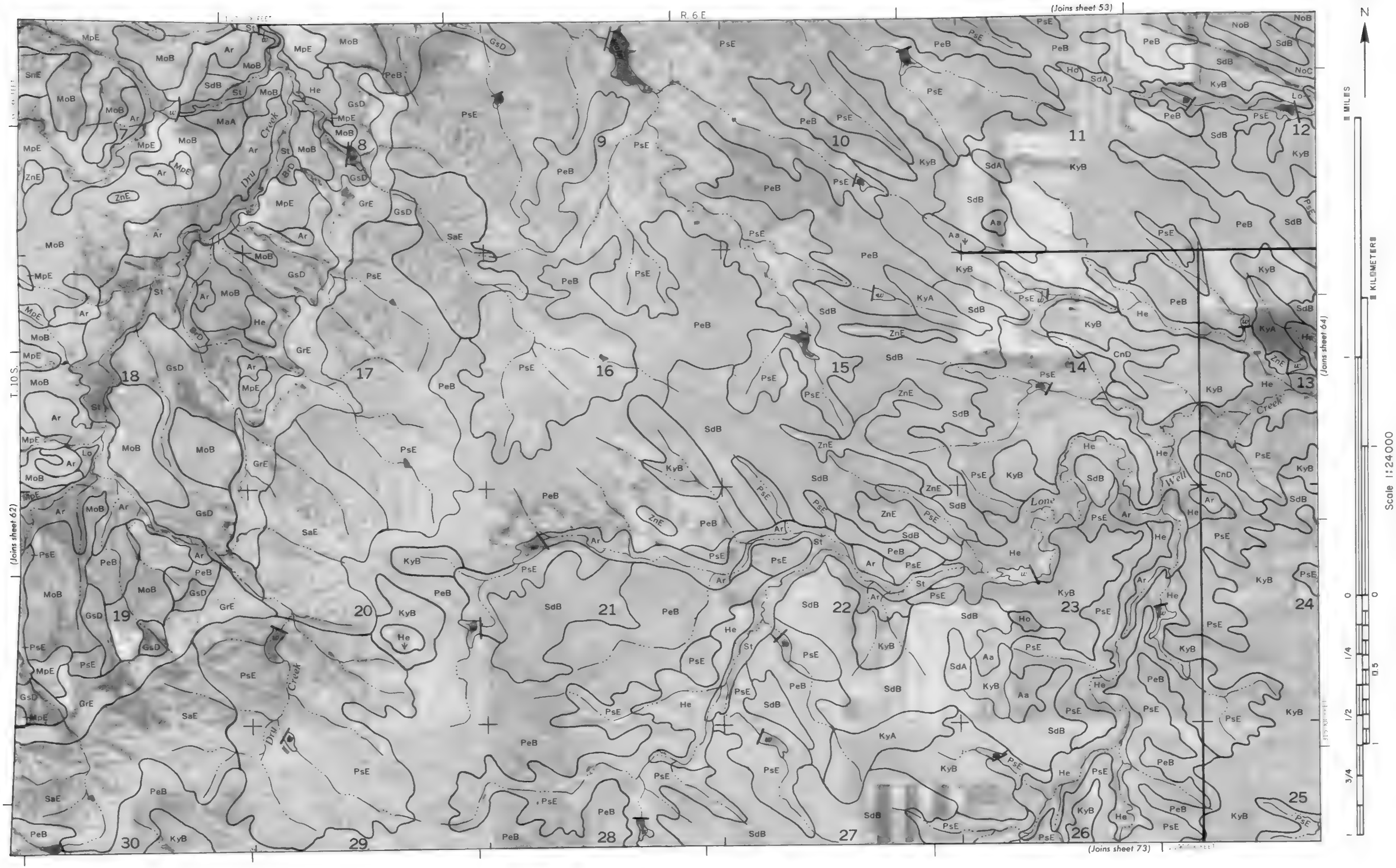

N
(Joins sheet 48)
R. 1 E. | R. 2 E.
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 68)
T. 10 S.
Scale 1:24000
2 MILES
2 KILOMETERS
0
1/4
1/2
3/4
0.5
Alum Creek
Softwater Creek
Creek
9
10
11
12
7
8
16
15
14
13
18
17
21
22
23
24
19
20
28
27
26
25
24
23
MpE
MoB
MbB
MbA
MaA
St
PsE
SnE
KyA
KyB
GsD
PeB
PgE
GrE
Ar
He
Le


59
N
(Joins sheet 49)
(Joins sheet 60)
(Joins sheet 69)
(Joins sheet 58)
R 2 E. | R 3 E.
T 10 S.
1 055 000 FEET
355 000 FEET
320 000 FEET
2 MILES
2 KILOMETERS
Scale 1:24 000
Igloo
Provo
water
BURLINGTON
NORTHERN
Coal Creek
Saltwater Creek
Plum Creek
Creek

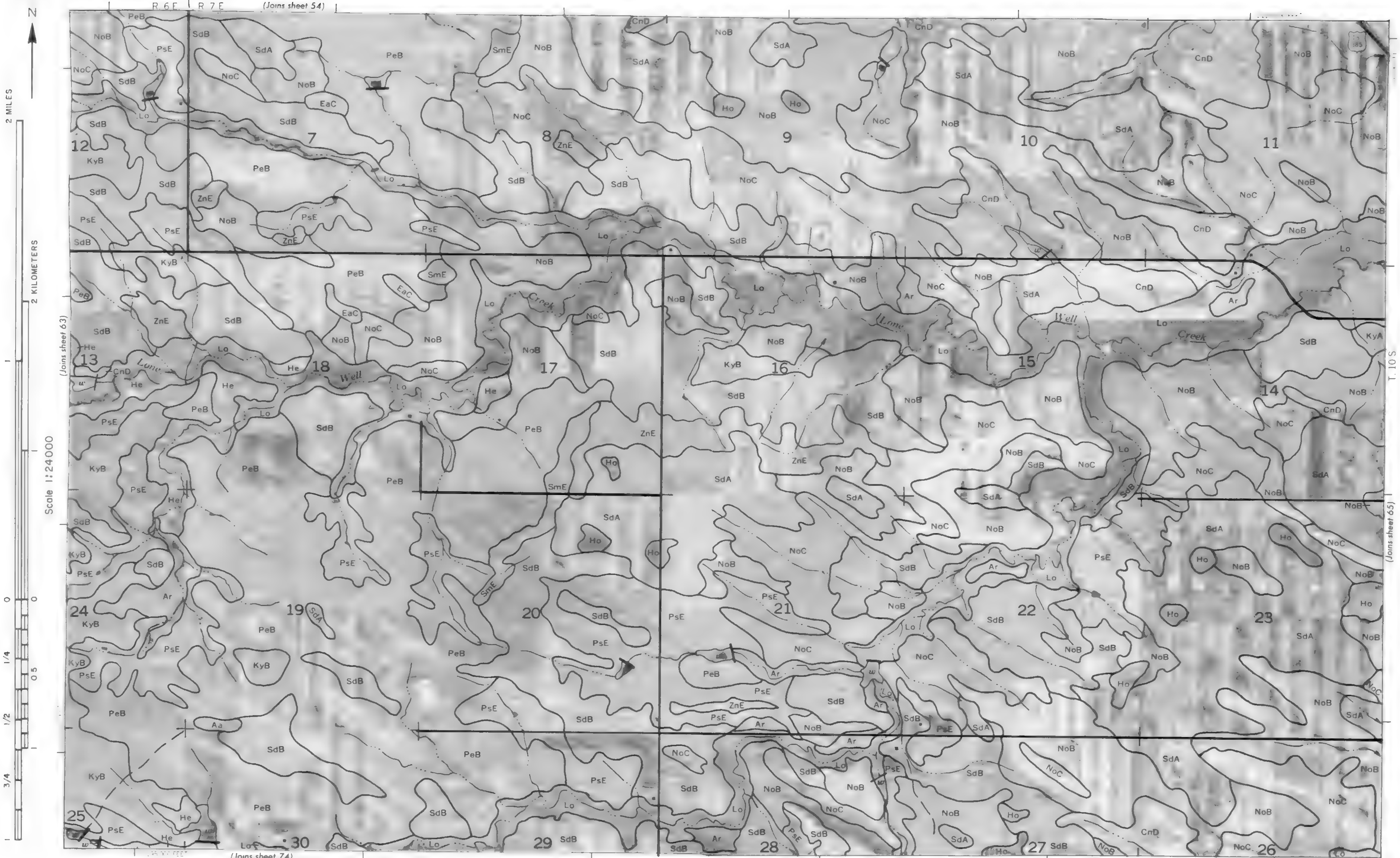

60
N
2 MILES
2 KILOMETERS
Scale 1:24 000
(Joins sheet 50)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 70)
R 3 E
R 4 E
T 10 S.
PLAINS VALLEY
Plains Creek
Pine Creek
Horse Creek
BURLINGTON NORTHERN
MpE
MbB
MoB
NoB
SdA
SdB
NoA
KyA
KyB
SnE
GrE
GsD
PgE
BrD
PsE
PeB
He
Aa
Ar
Lo
St
MbA
ZnE
BrD
1
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30


61
N
(Joins sheet 51)
R. 4 E. R. 5 E.
(Joins sheet 62)
(Joins sheet 60)
(Joins sheet 71)
T. 10 S.
2 MILES
2 KILOMETERS
Scale 1:24 000
Pine Creek
Hat Creek
Horse Creek
Ash Creek

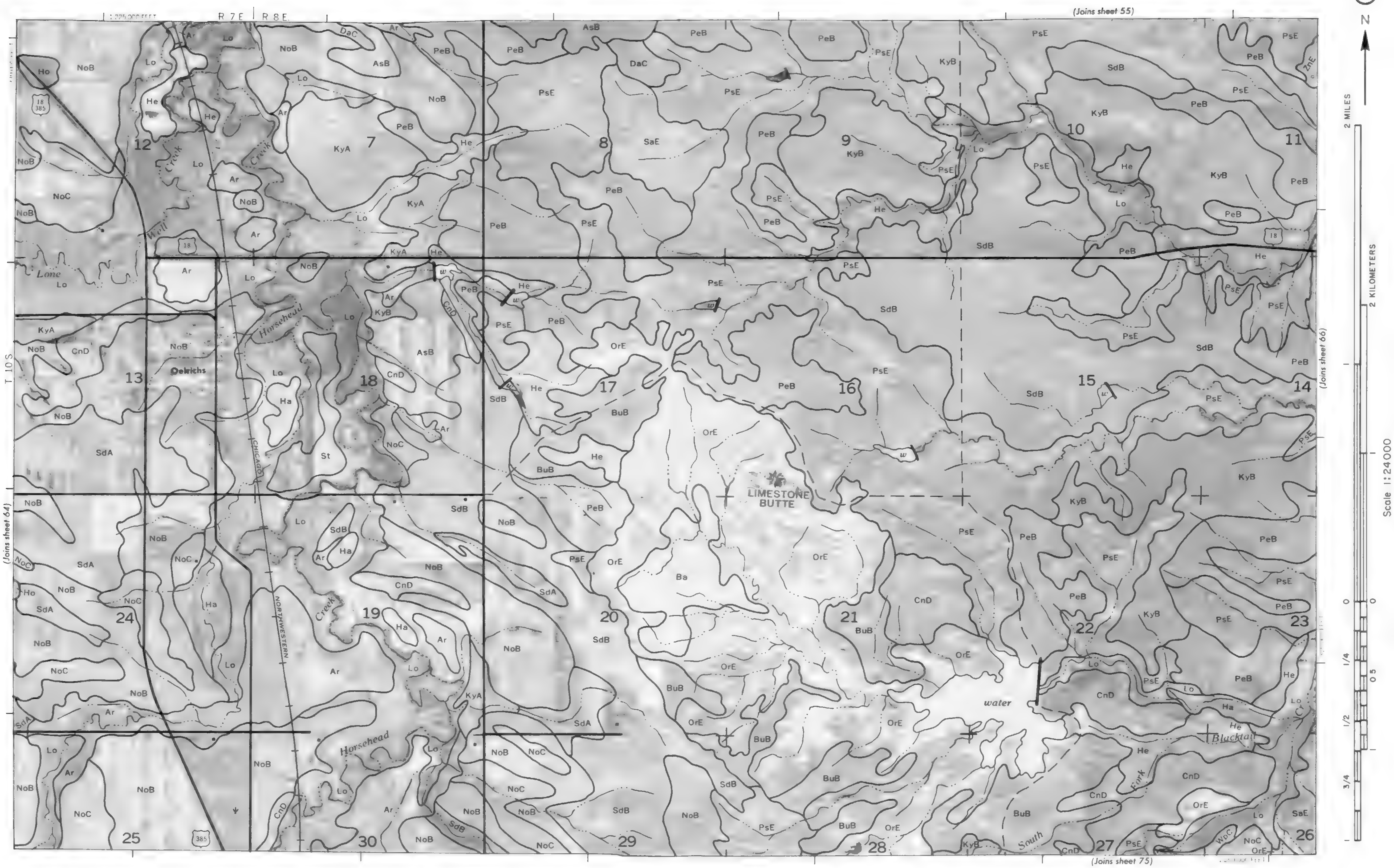

N
(Joins sheet 52)
R. 5 E
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 72)
T. 10 S
Ash Creek
2 MILES
2 KILOMETERS
Scale 1:24000

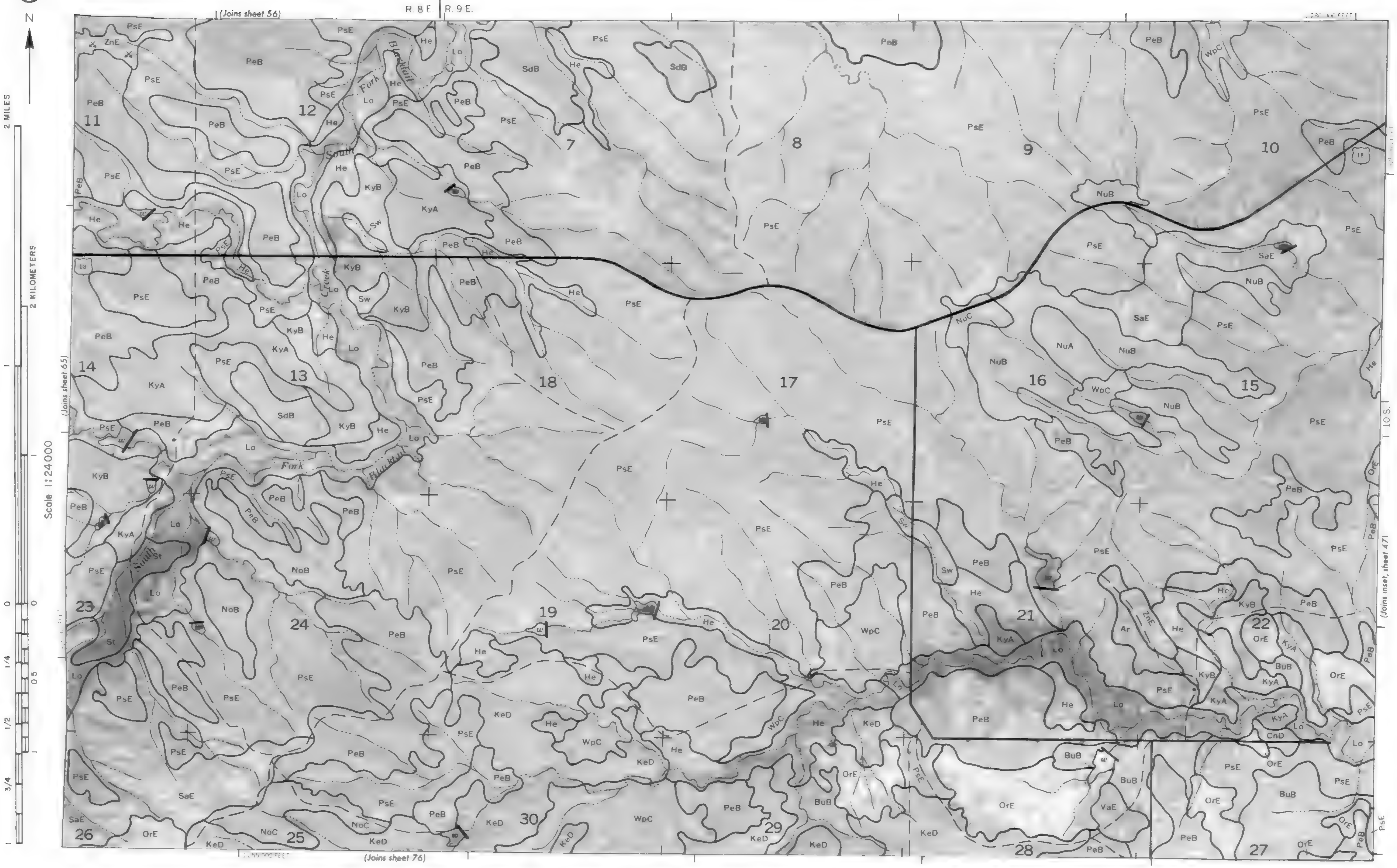


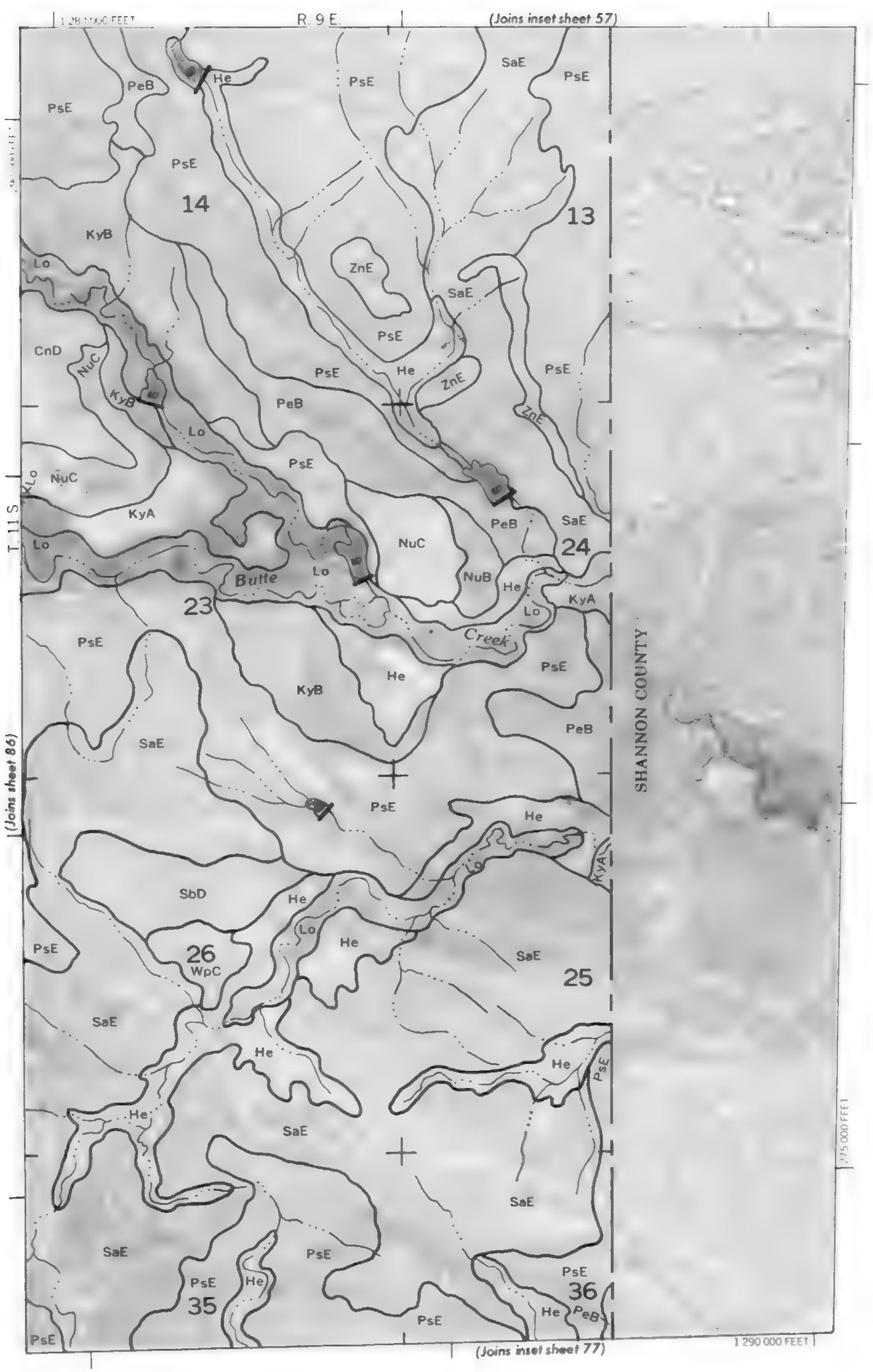
(Joins sheet 53)
R. 6 E.
T. 10 S.
(Joins sheet 62)
(Joins sheet 64)
(Joins sheet 73)
Dry Creek
Lone Well Creek
N
MILES
KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5

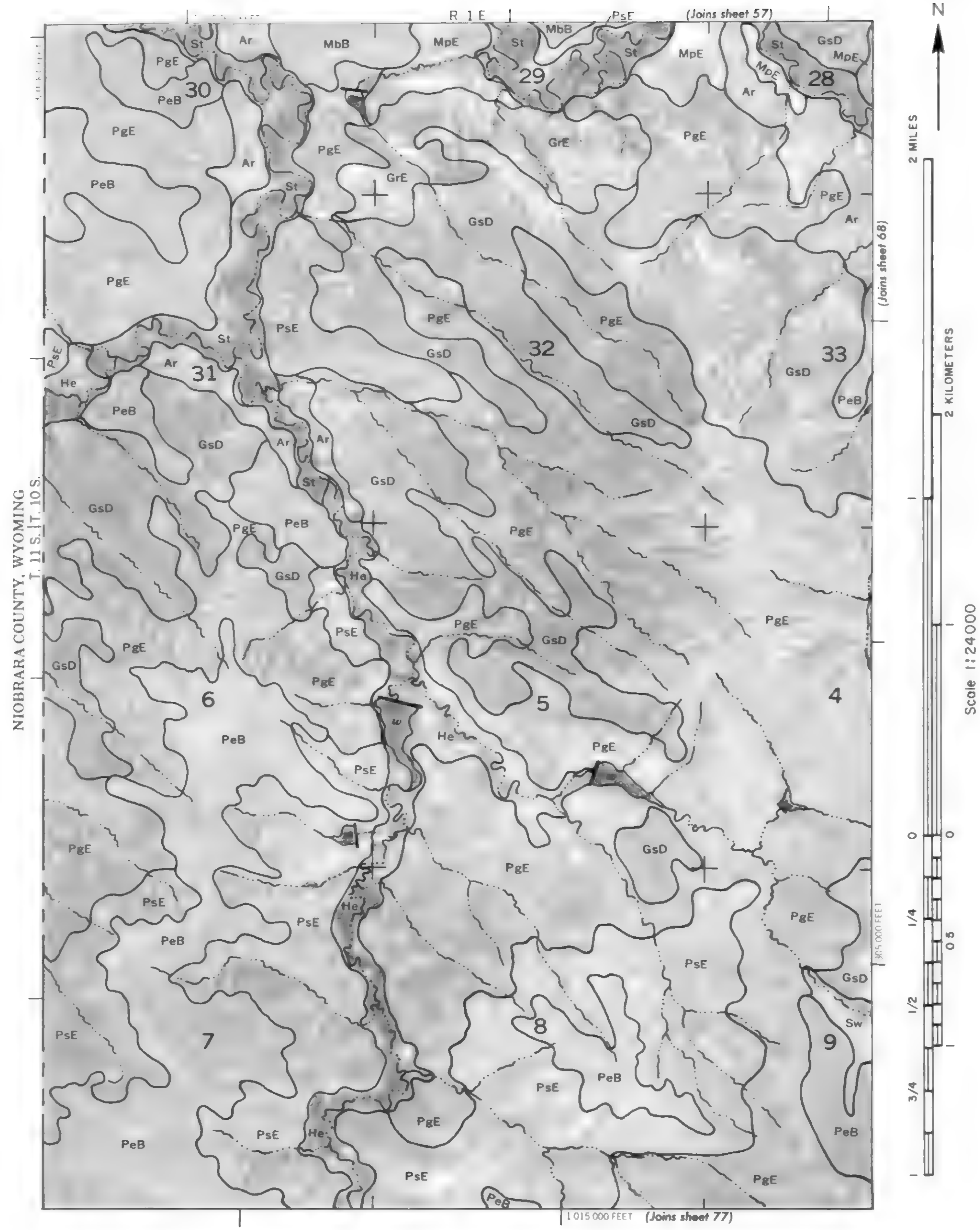

N
2 MILES
2 KILOMETERS
Scale 1:24000
R. 6 E.
R. 7 E.
(Joins sheet 54)
(Joins sheet 63)
(Joins sheet 65)
(Joins sheet 74)
T. 10 S.
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Lone Well Creek

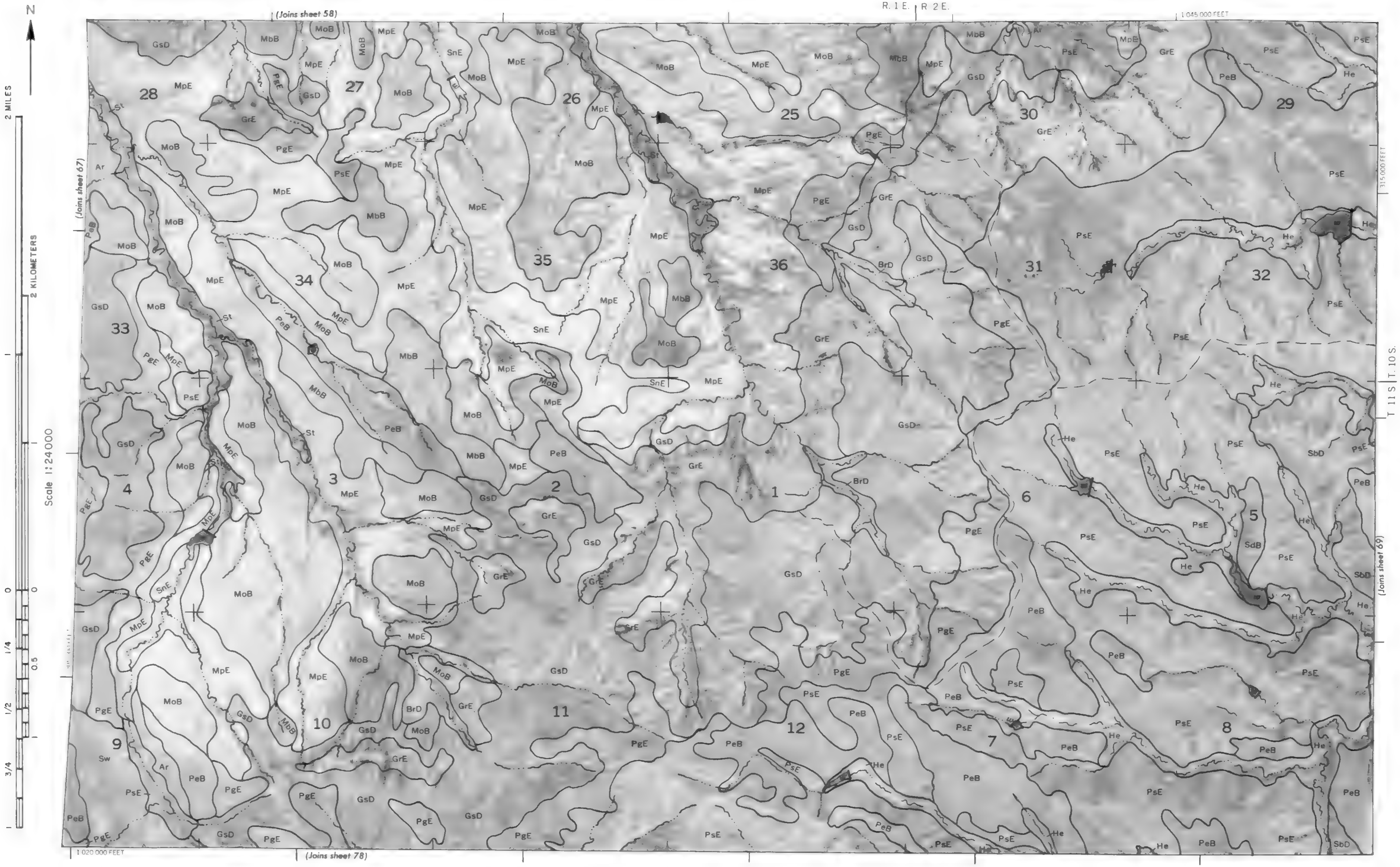
65

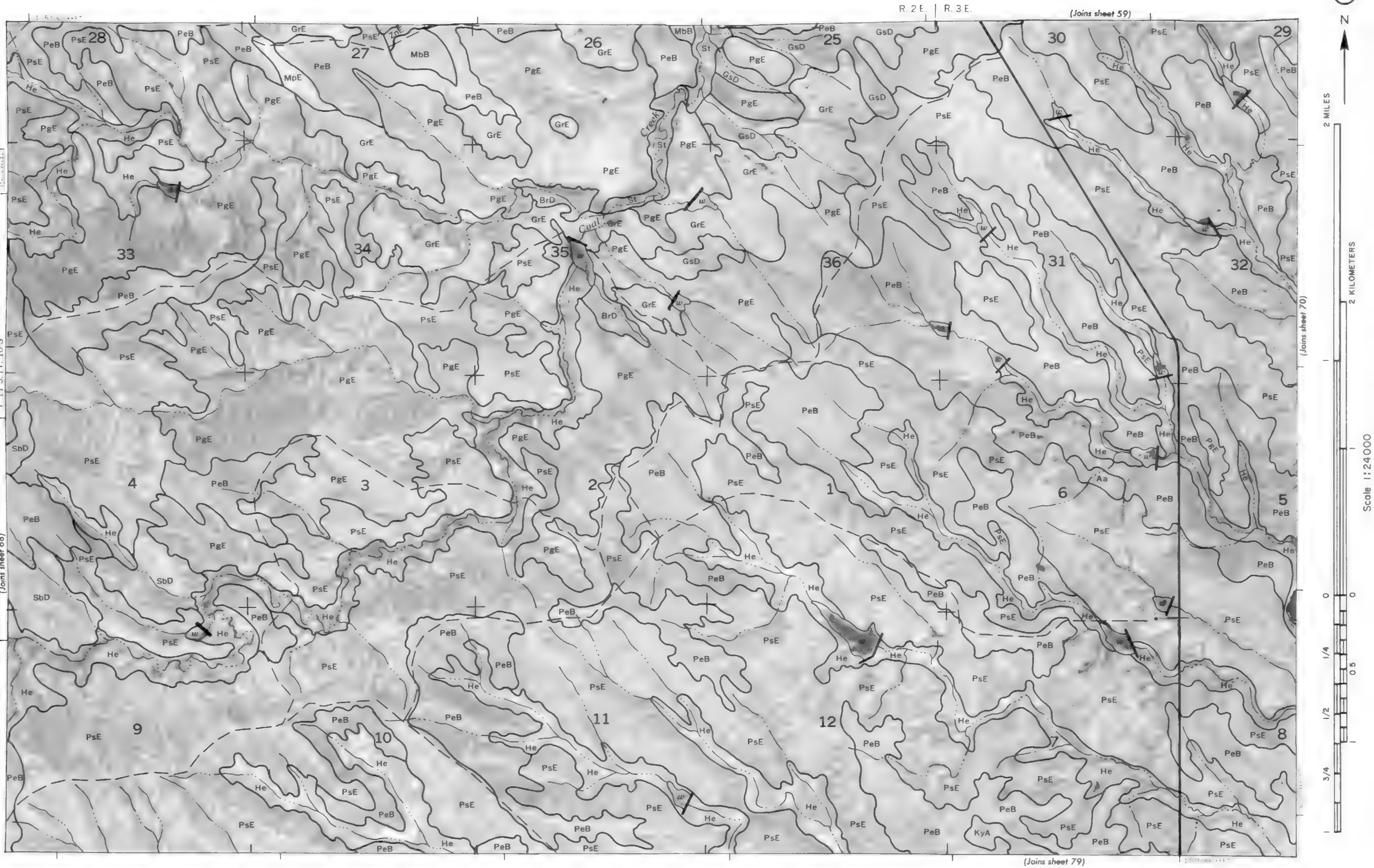

(Joins sheet 55)
(Joins sheet 66)
(Joins sheet 75)
(Joins sheet 64)
R 7 E
R 8 E
T 10 S
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
LIMESTONE BUTTE
Oelrichs
Lone
Well
Creek
Horsehead
Creek
Horsehead
CHICAGO
NORTHWESTERN
South
Fork
Blacktail
water
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Ho
NoB
NoC
Lo
He
Ar
AsB
DaC
PeB
PsE
SaE
KyA
KyB
SdB
SdA
CnD
OrE
BuB
Ba
Ha
St
w
ZnE
WoC
18
385

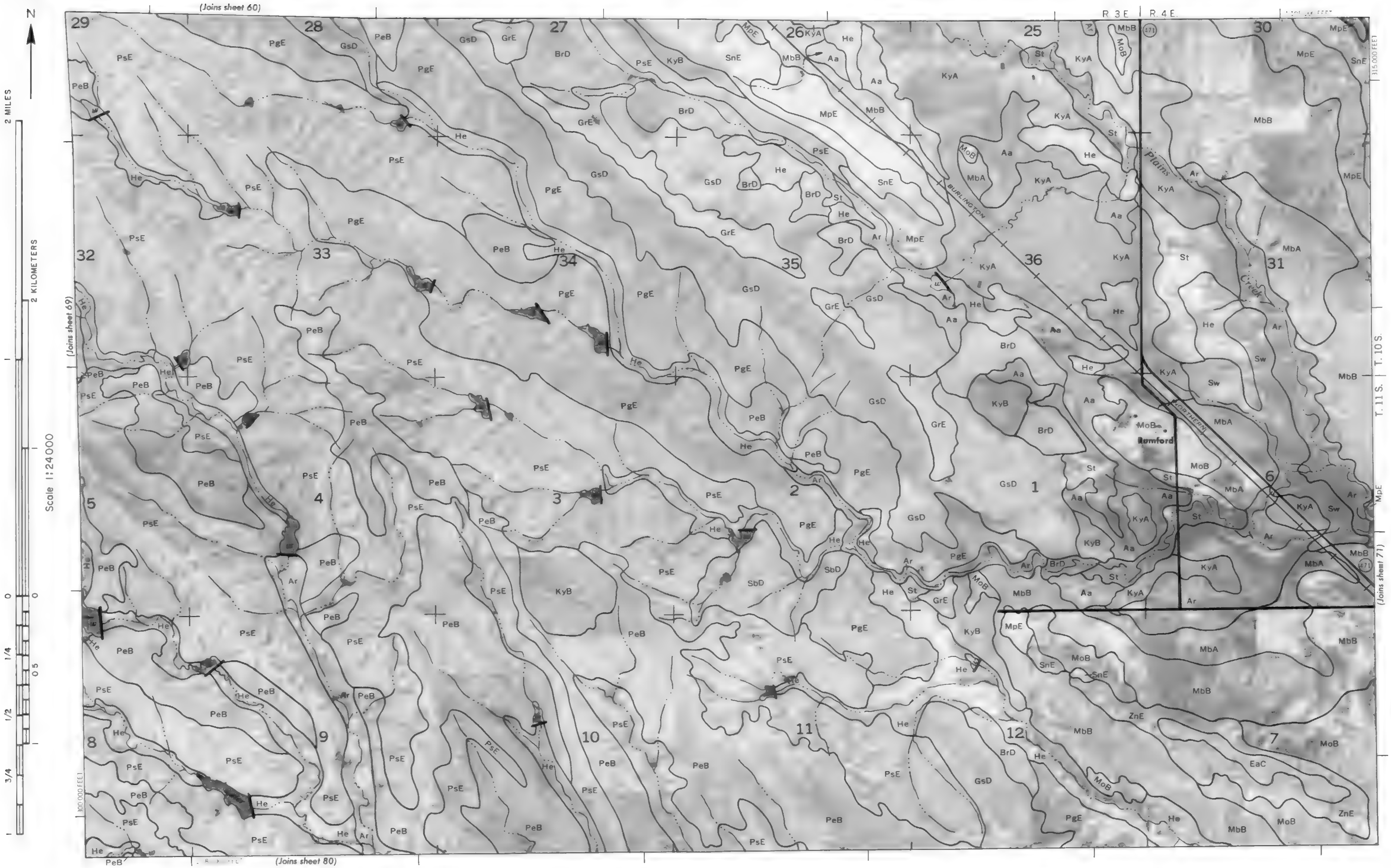

N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 56)
R. 8 E. | R. 9 E.
(Joins sheet 65)
(Joins inset, sheet 47)
T. 10 S.
(Joins sheet 76)
Fork
Blacktail
South
Creek
18

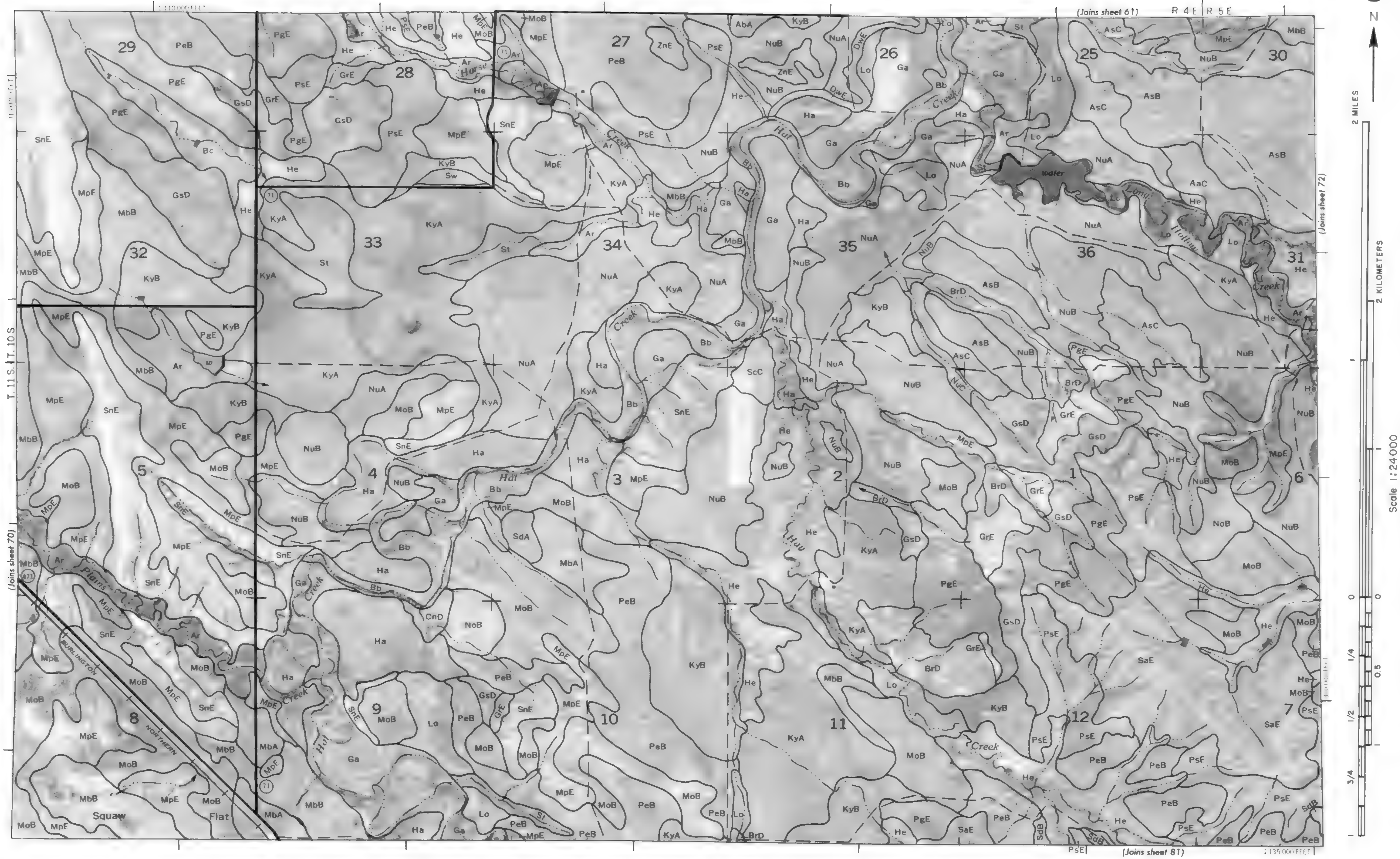

R. 9 E.
(Joins inset sheet 57)
T. 11 S.
(Joins sheet 86)
Butte
Creek
SHANNON COUNTY
(Joins inset sheet 77)
1 290 000 FEET

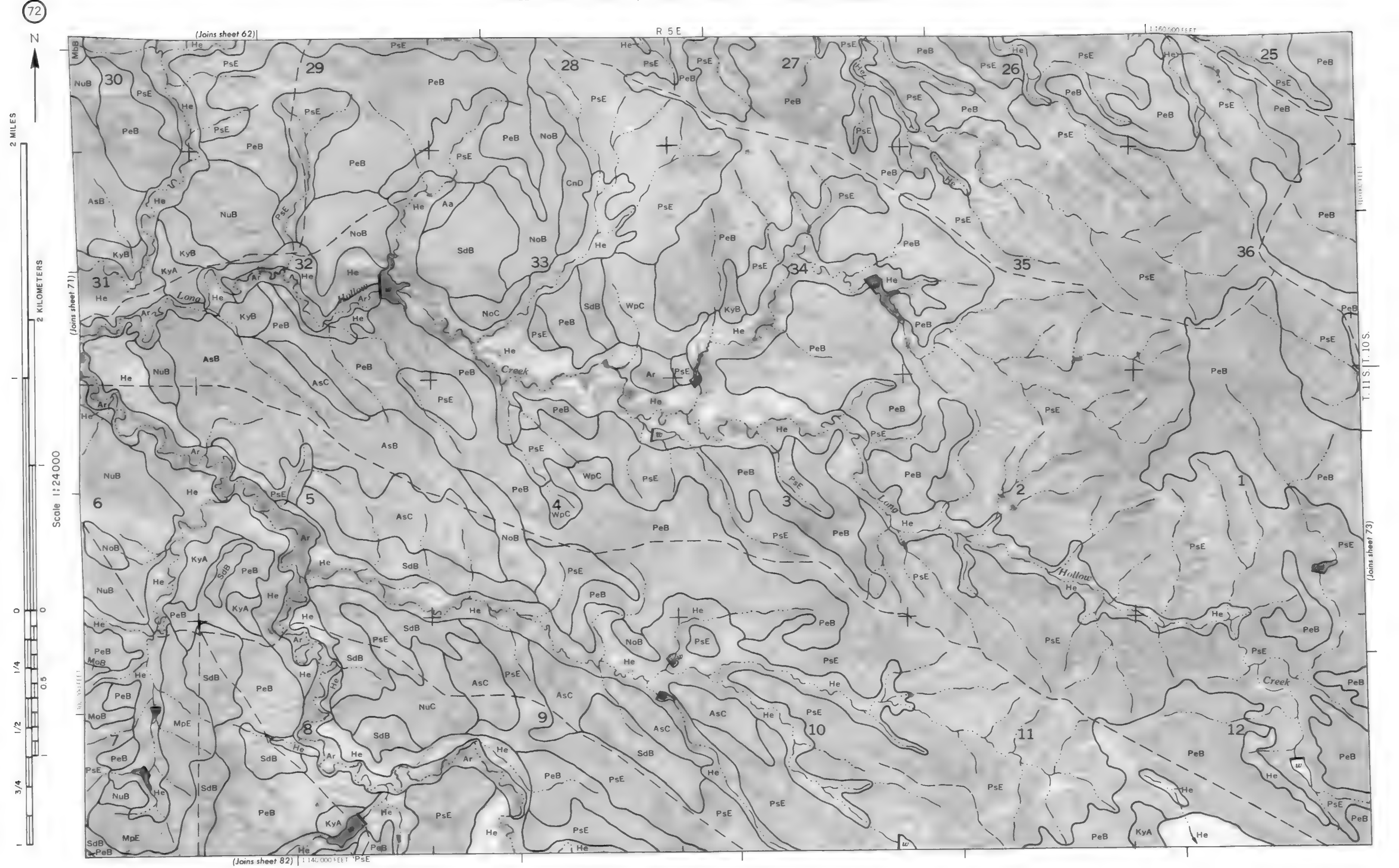

R. 1 E.
(Joins sheet 57)
(Joins sheet 68)
NIOBRARA COUNTY, WYOMING
T. 11 S. | T. 10 S.
1 015 000 FEET
(Joins sheet 77)
N
2 MILES
2 KILOMETERS
Scale 1:24000

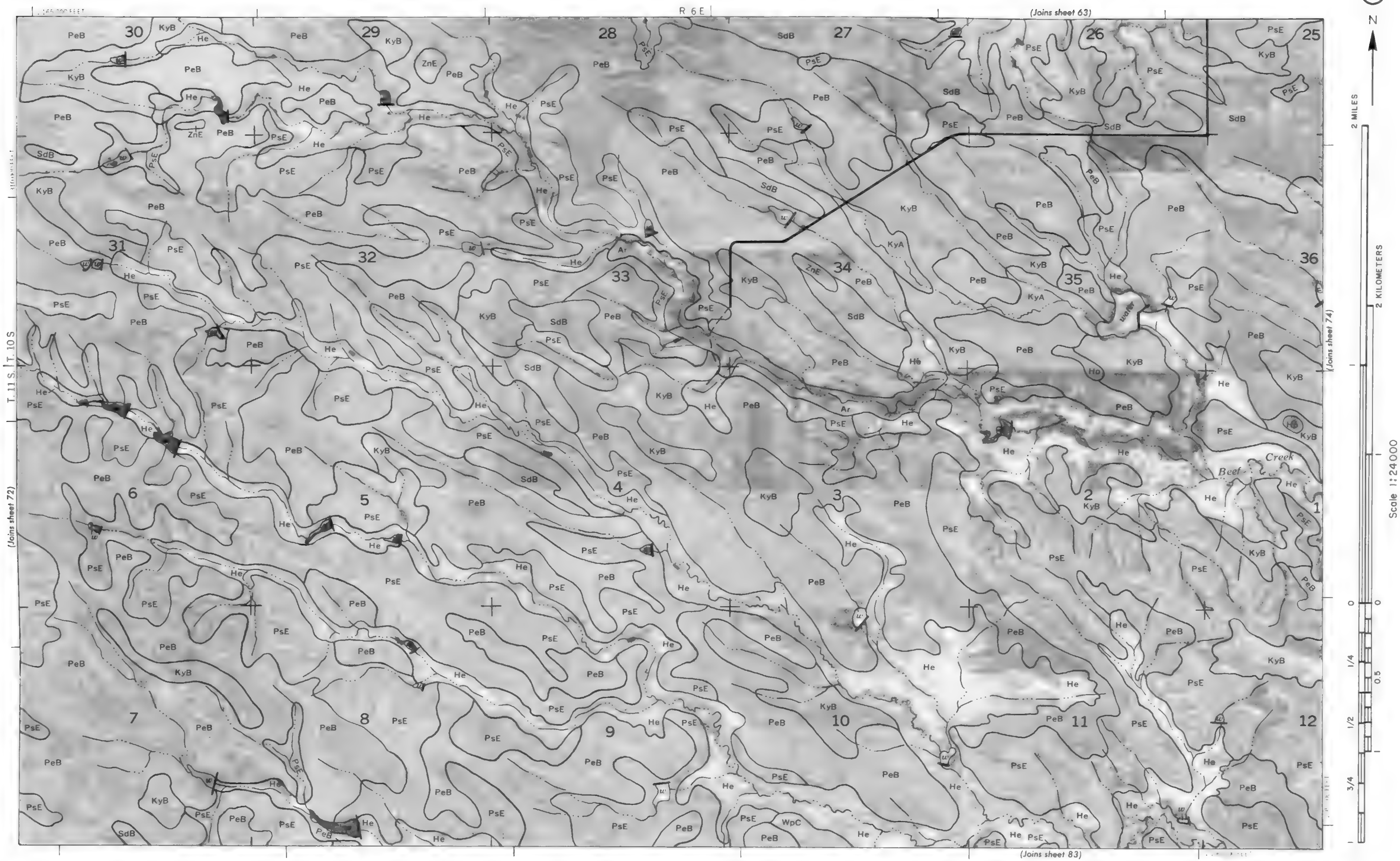

N
(Joins sheet 58)
R. 1 E. | R. 2 E.
1 045 000 FEET
(Joins sheet 67)
315 000 FEET
T. 10 S.
T. 11 S.
(Joins sheet 69)
1 020 000 FEET
(Joins sheet 78)
2 MILES
2 KILOMETERS
Scale 1:24000

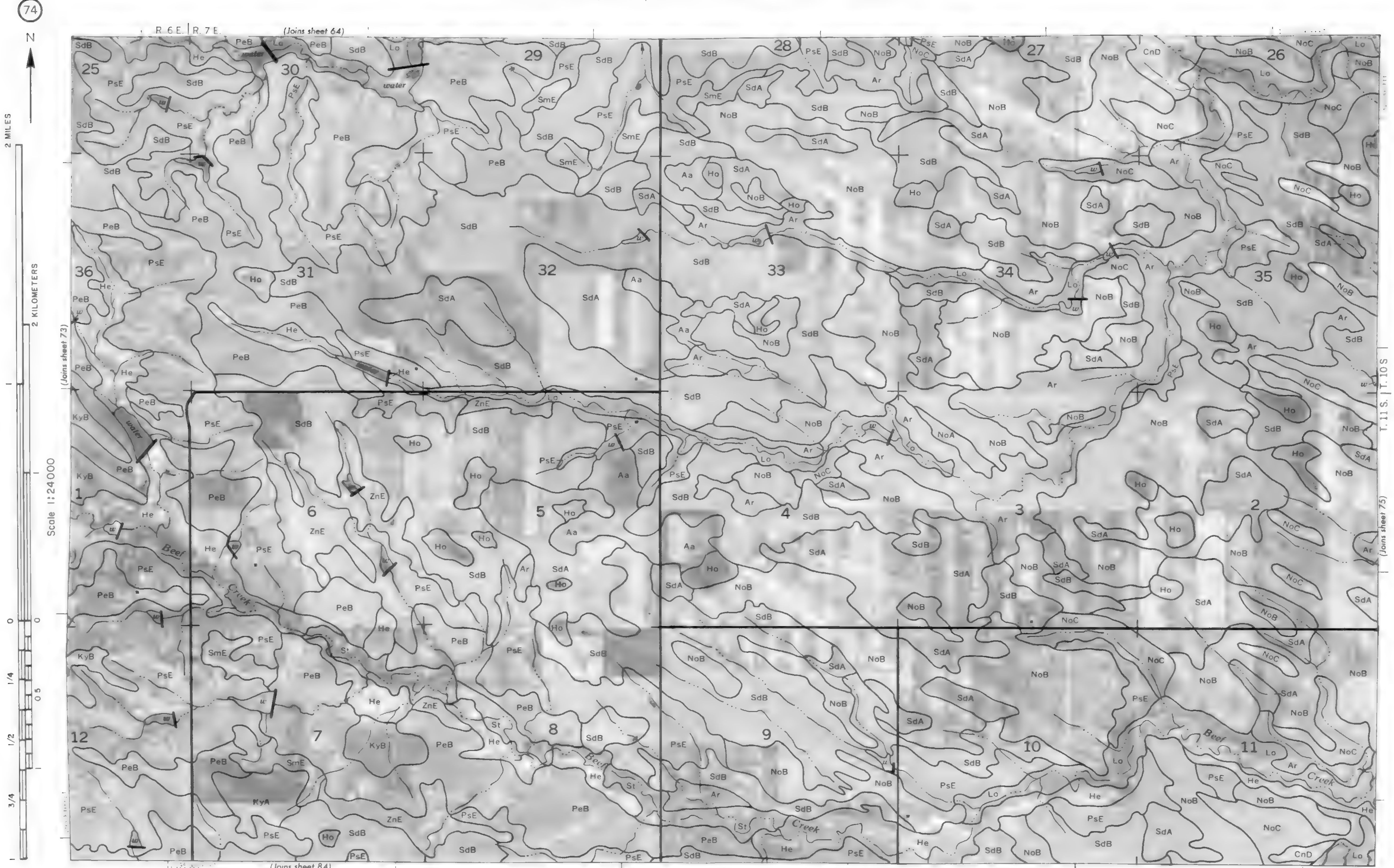

R. 2 E.
R. 3 E.
(Joins sheet 59)
(Joins sheet 70)
(Joins sheet 68)
(Joins sheet 79)
T. 10 S.
T. 11 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
Coal
Creek
28
27
26
25
30
29
33
34
35
36
31
32
4
3
2
1
6
5
9
10
11
12
7
8
PeB
PsE
PgE
GrE
MbB
MpE
GsD
St
BrD
He
SbD
Aa
KyA


N
2 MILES
2 KILOMETERS
Scale 1:24 000
(Joins sheet 60)
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 80)
R. 3 E.
R. 4 E.
T. 10 S.
T. 11 S.
Rumford
Plains Creek
BURLINGTON NORTHERN

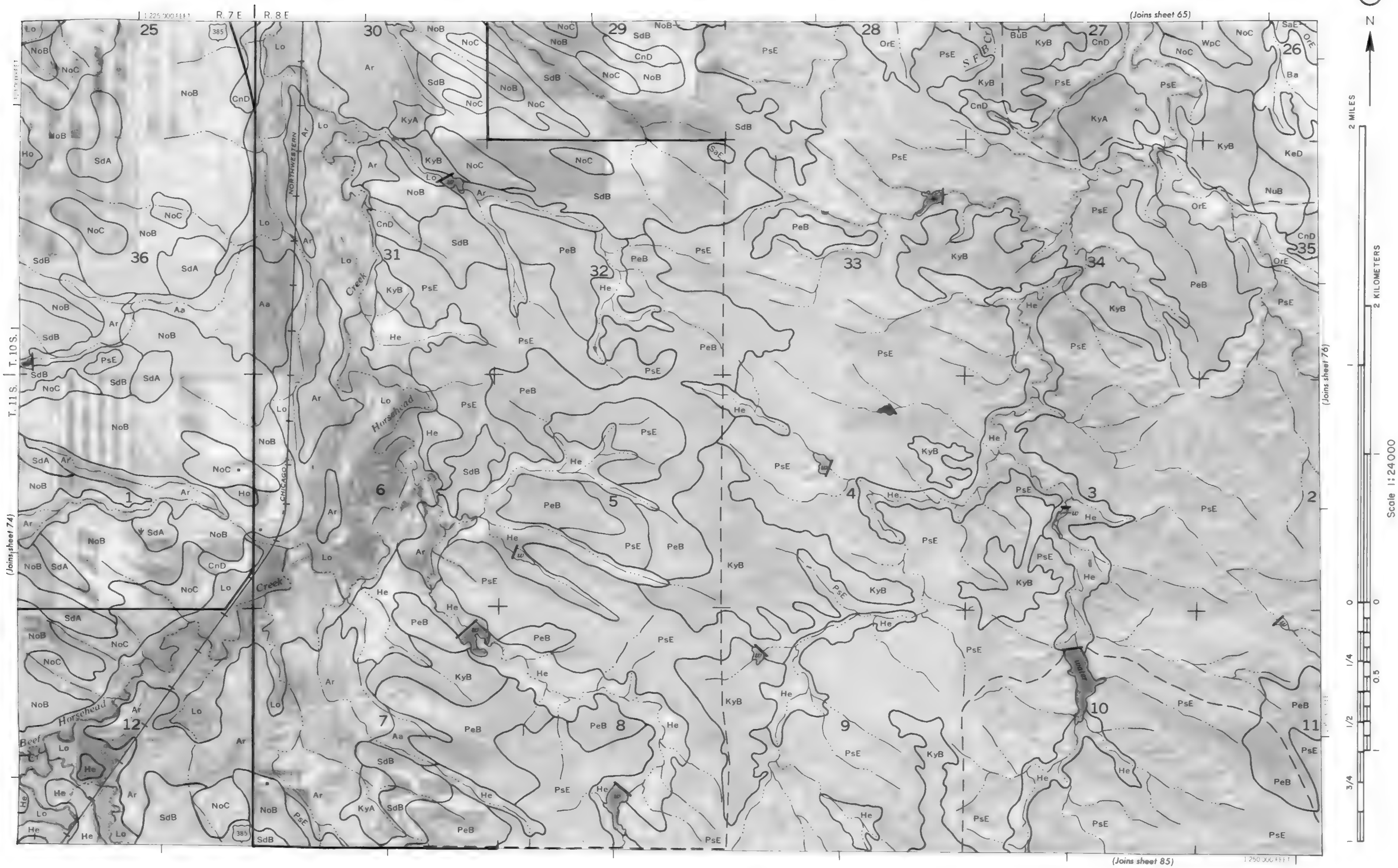

71
N
(Joins sheet 61)
R 4 E | R 5 E
(Joins sheet 72)
(Joins sheet 70)
(Joins sheet 81)
T. 11 S. | T. 10 S.
Scale 1:24000
2 MILES
2 KILOMETERS
Long Hollow Creek
Hat Creek
Horse Creek
Plains
Squaw Flat
BURLINGTON NORTHERN
water

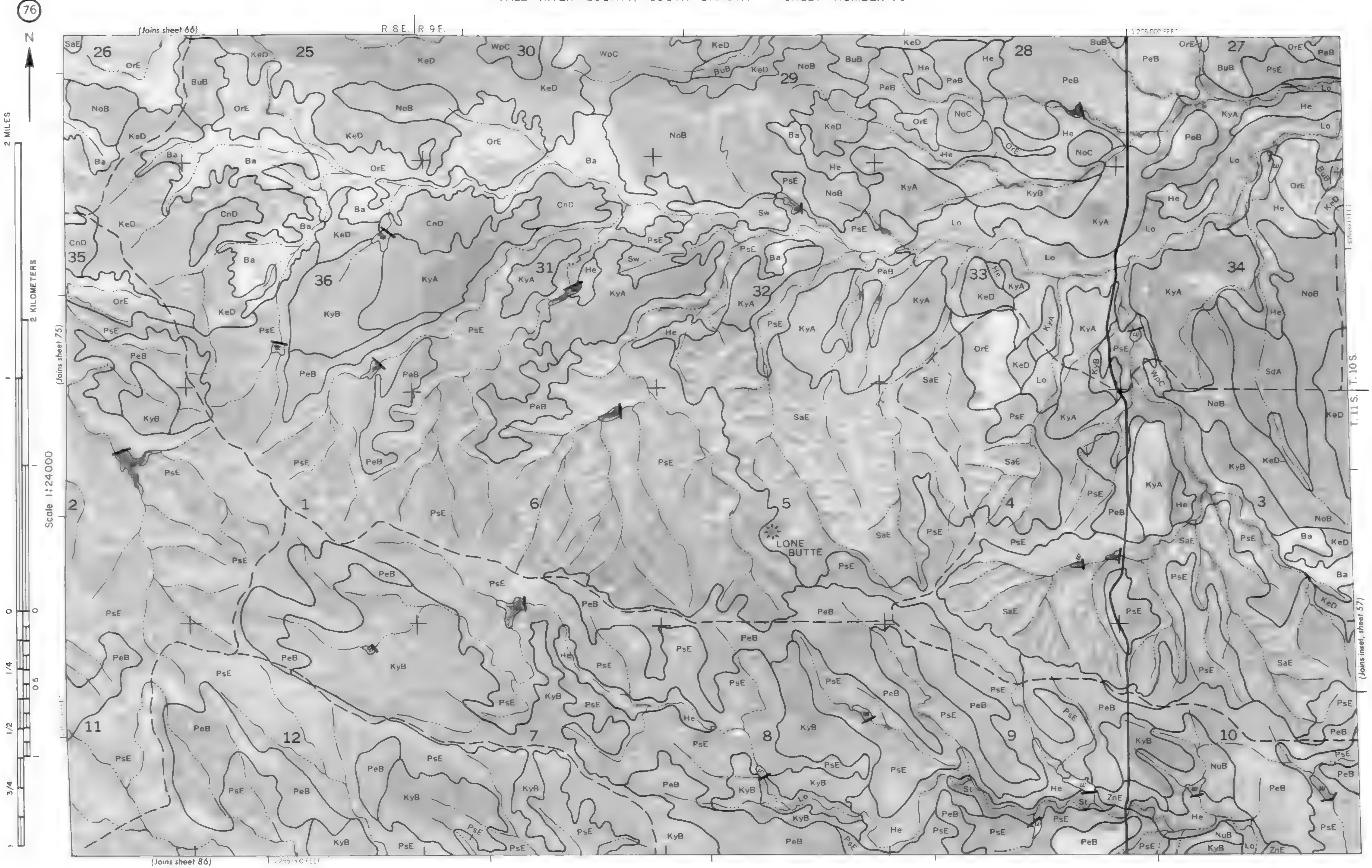

N
(Joins sheet 62)
R 5 E
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 82)
T. 10 S.
T. 11 S.
2 MILES
2 KILOMETERS
Scale 1:24000
Long Hollow
Creek
Long Hollow
Creek
1 140 000 FEET
1 160 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
25
26
27
28
29
30
31
32
33
34
35
36

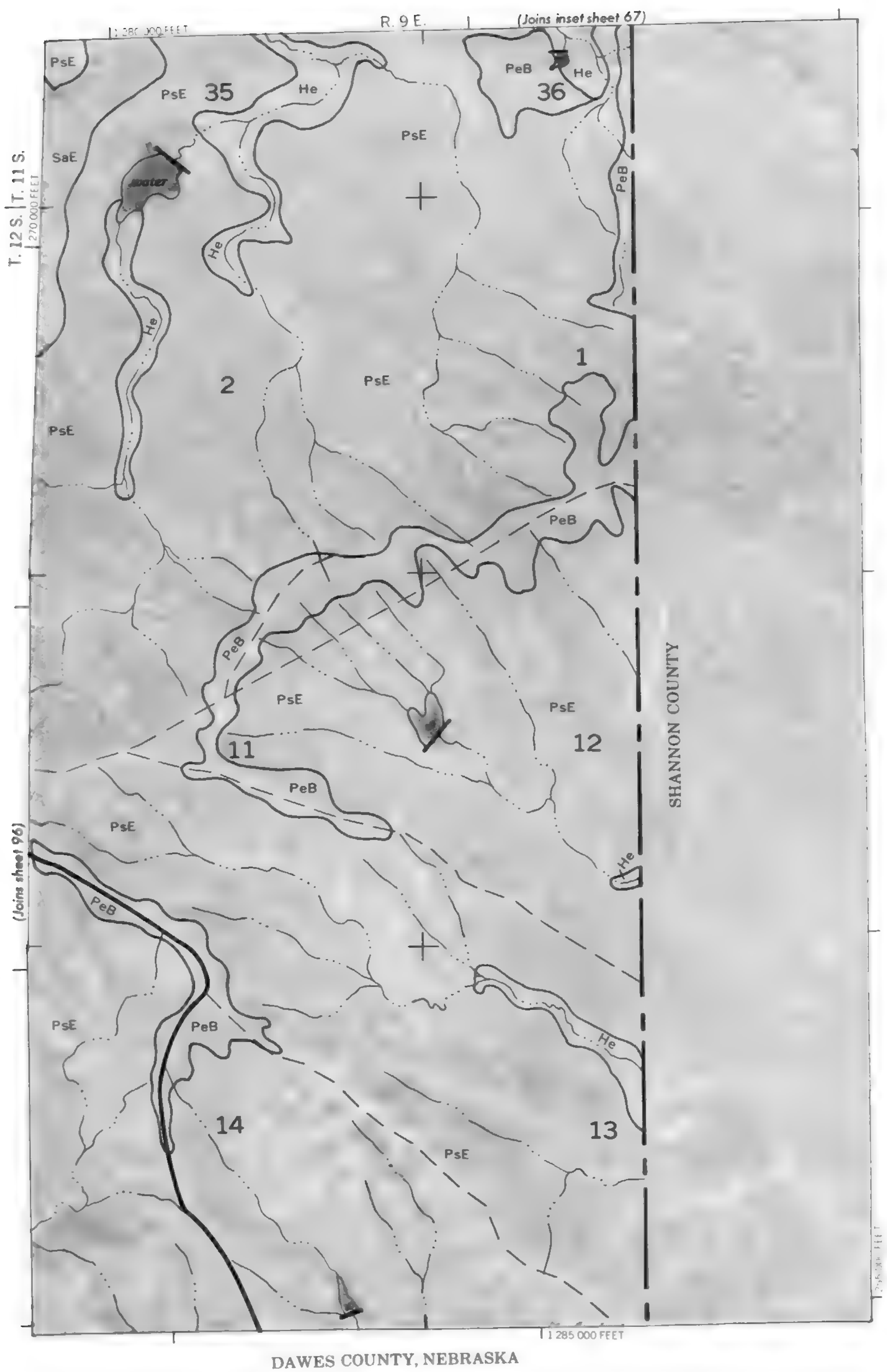

R 6 E
(Joins sheet 63)
(Joins sheet 72)
(Joins sheet 74)
(Joins sheet 83)
T. 11 S.
T. 10 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
1
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
Beef
Creek
PeB
KyB
He
ZnE
PsE
SdB
KyA
Ar
Ho
WpC

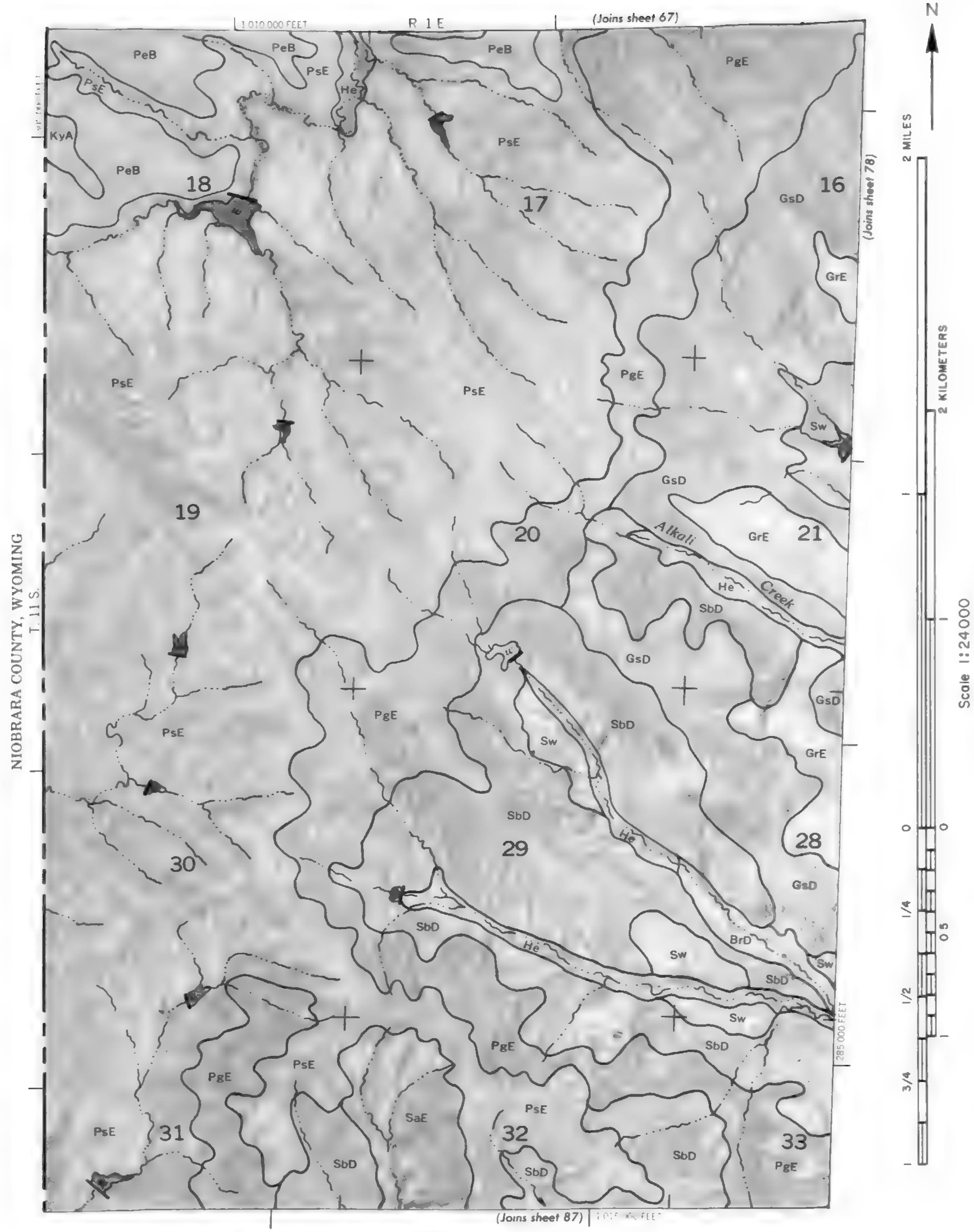

74
N
R. 6 E. | R. 7 E.
(Joins sheet 64)
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 84)
T. 10 S. | T. 11 S.
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
0.5
25
30
29
28
27
26
36
31
32
33
34
35
1
6
5
4
3
2
12
7
8
9
10
11
Beef Creek
water

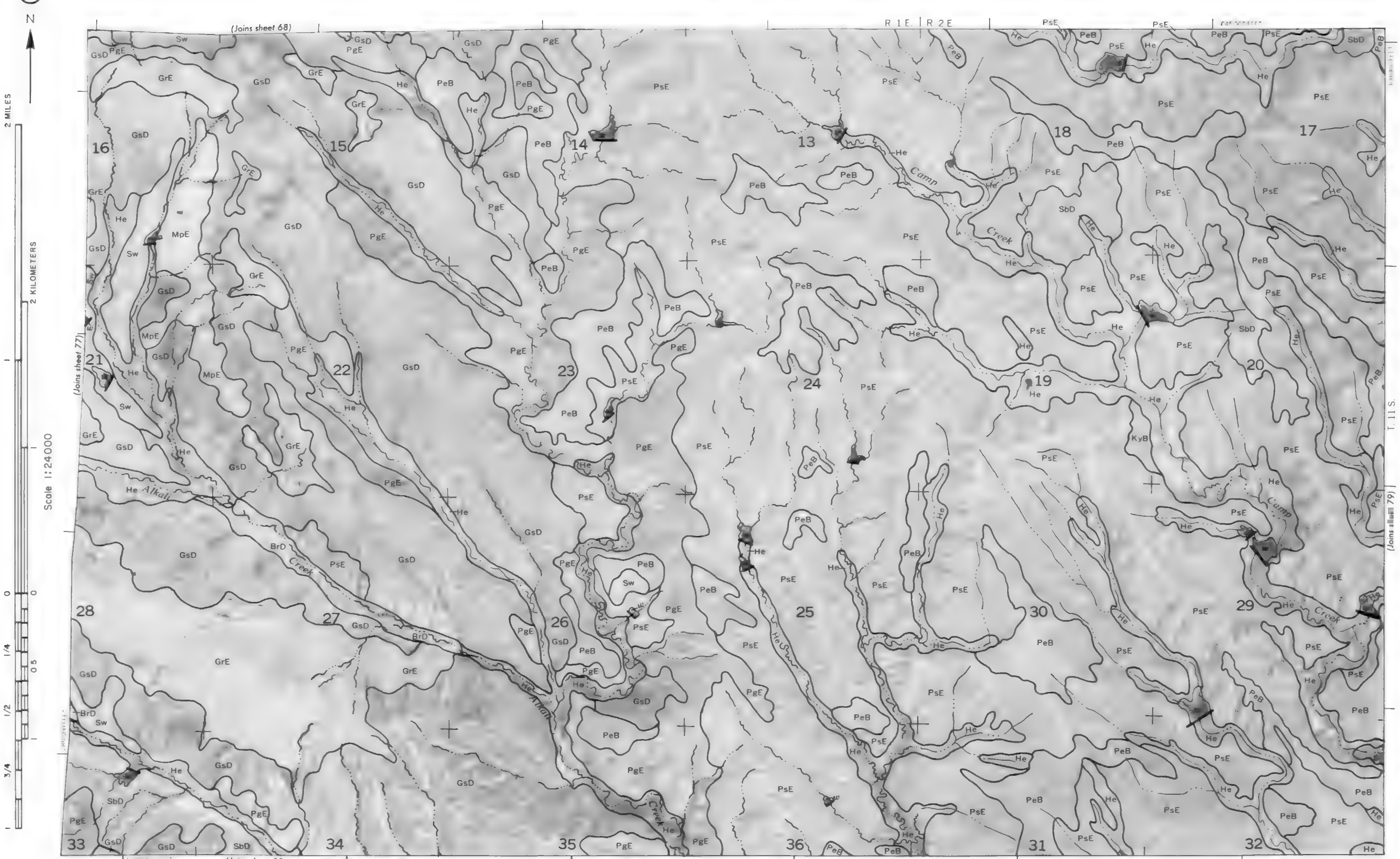
FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 75

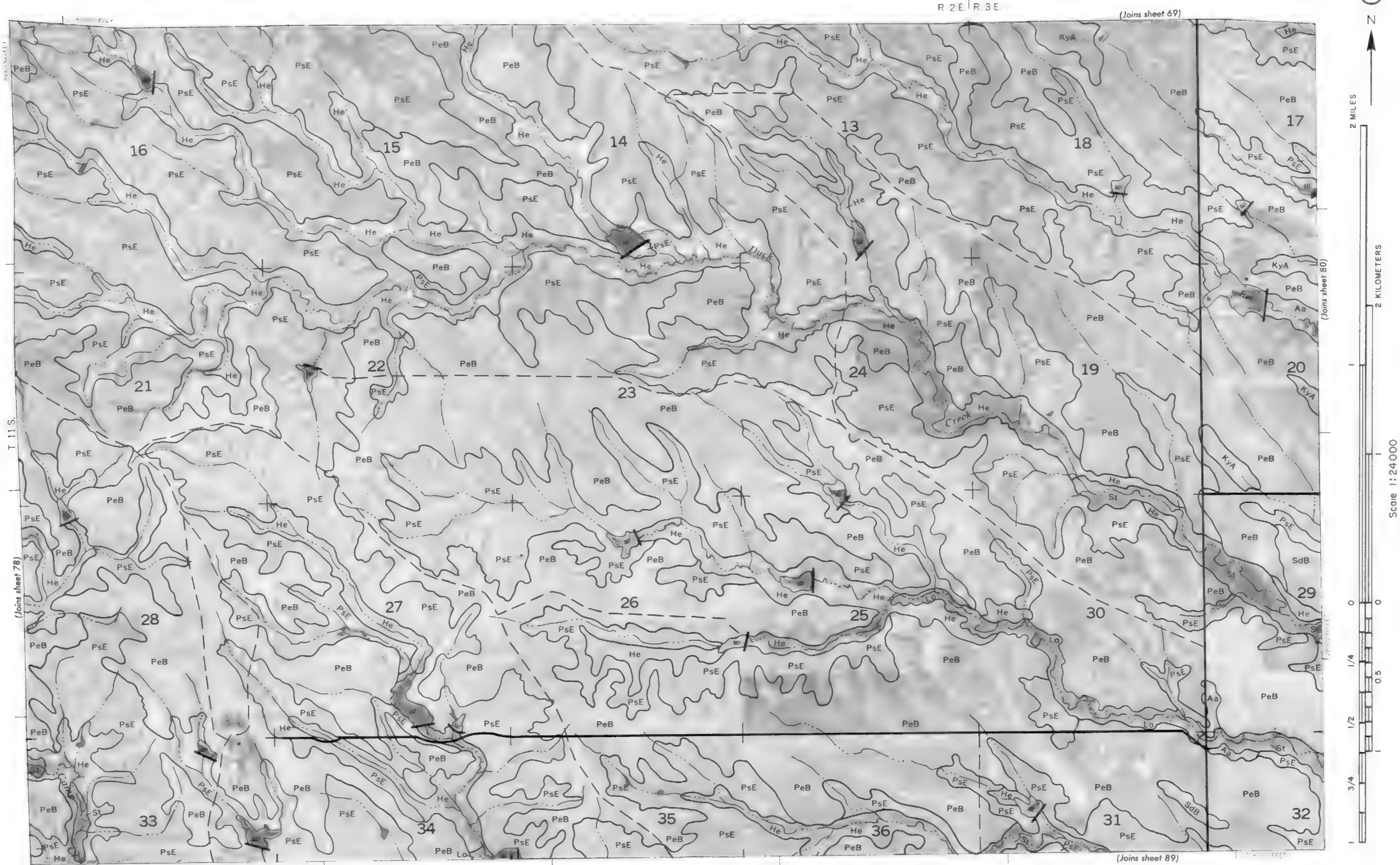


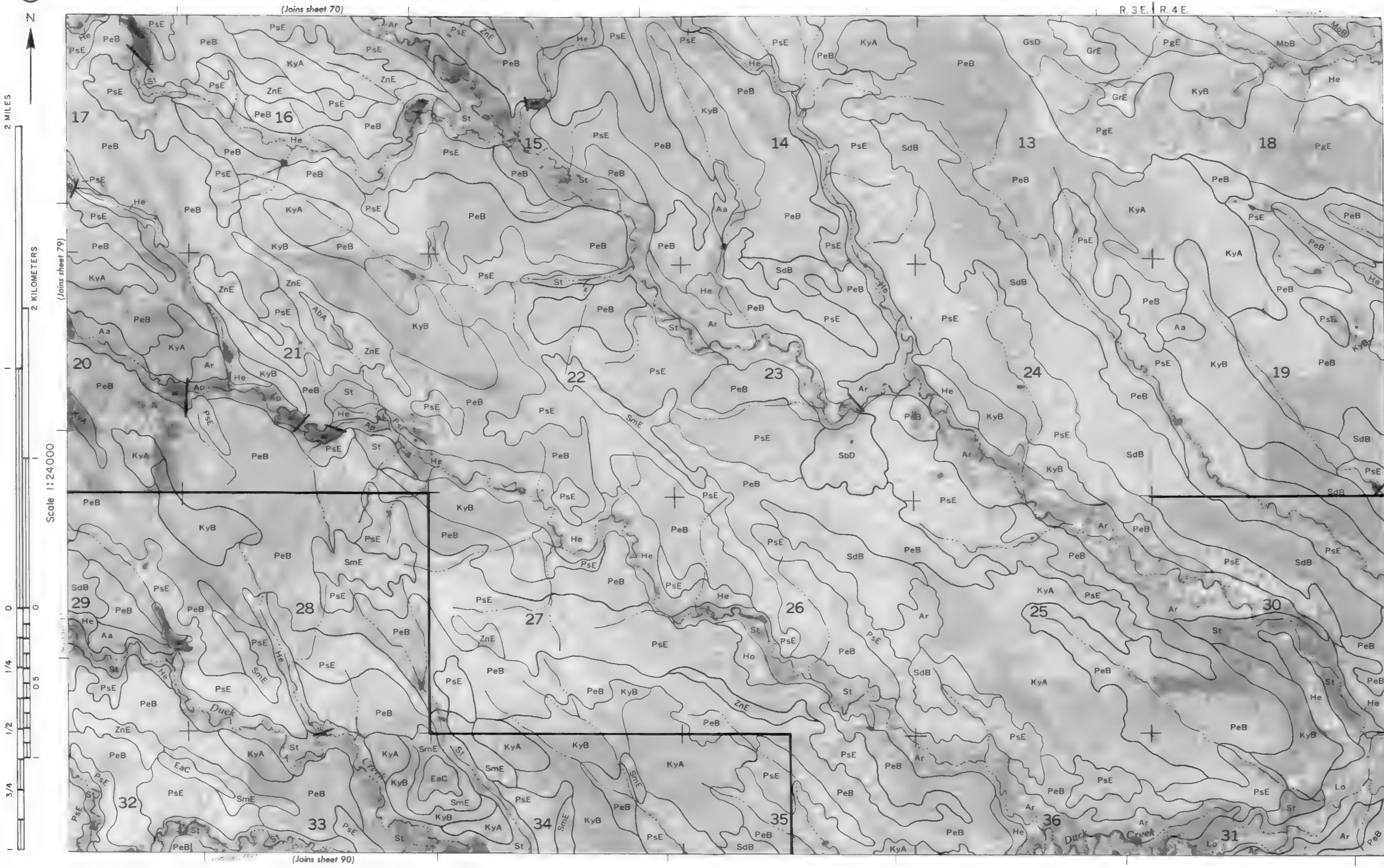

76
N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 66)
R 8 E. | R 9 E.
1 275 000 FEET
(Joins sheet 75)
T. 10 S.
T. 11 S.
(Joins inset, sheet 57)
(Joins sheet 86)
1 255 000 FEET
26
25
30
29
28
27
35
36
31
32
33
34
2
1
6
5
4
3
11
12
7
8
9
10
LONE BUTTE
SaE
OrE
KeD
BuB
NoB
Ba
CnD
KyA
KyB
PsE
PeB
WpC
He
NoC
Lo
Sw
SdA
St
ZnE
NuB

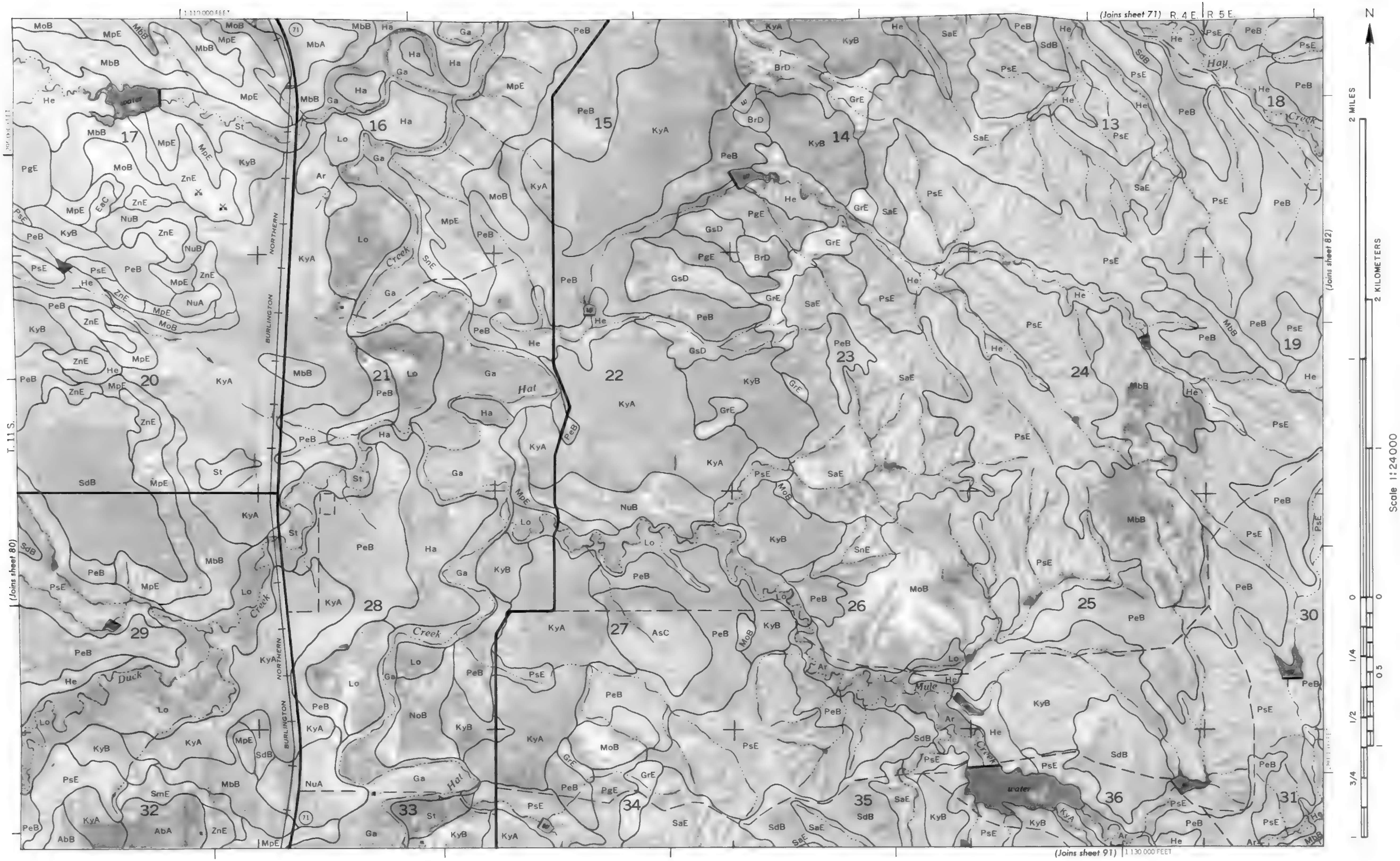

R. 9 E.
(Joins inset sheet 67)
1 280 000 FEET
T. 12 S. | T. 11 S.
270 000 FEET
(Joins sheet 96)
SHANNON COUNTY
1 285 000 FEET
DAWES COUNTY, NEBRASKA
35
36
2
1
11
12
14
13
PsE
SaE
PeB
He
water

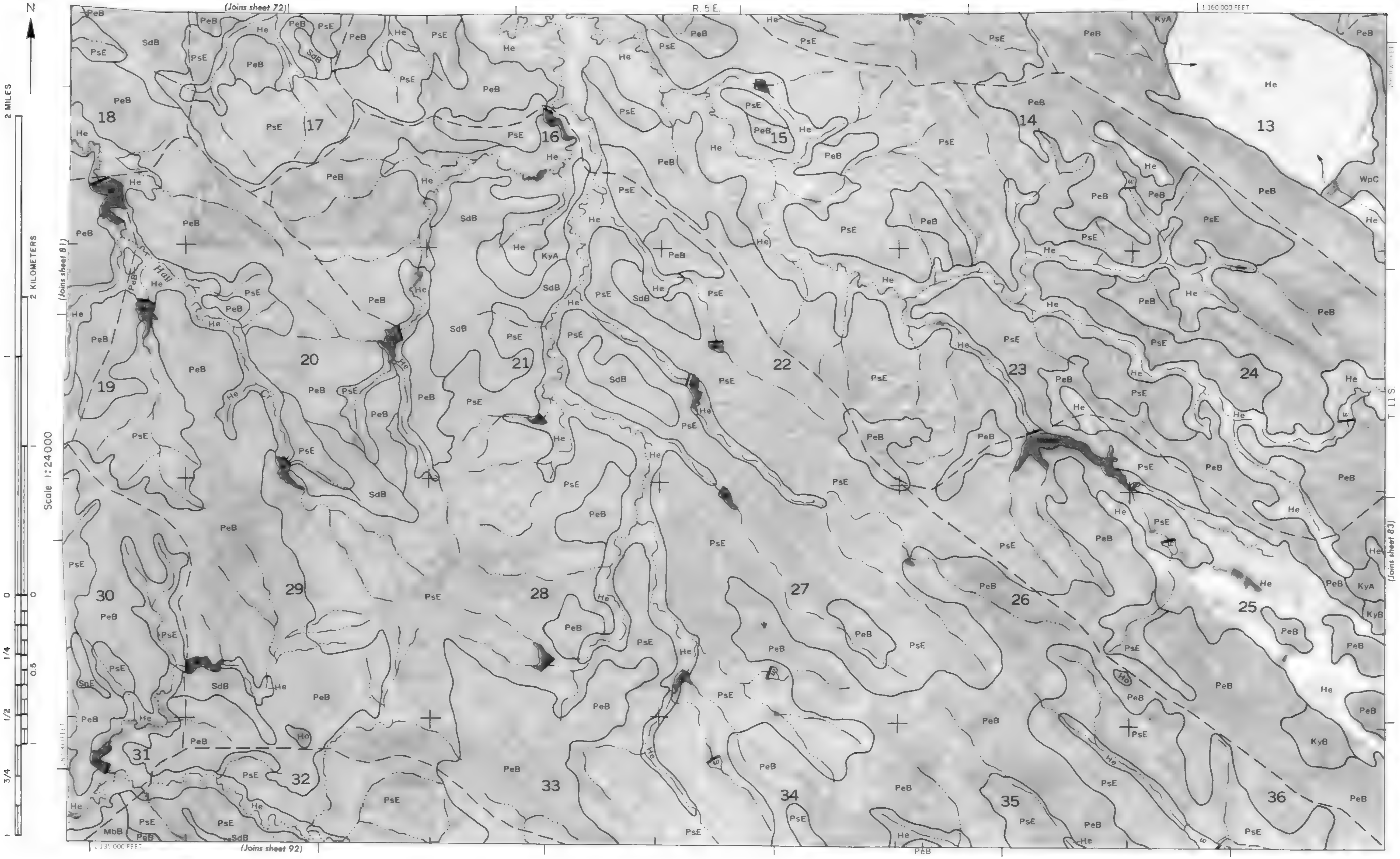

1 010 000 FEET
R. 1 E.
(Joins sheet 67)
(Joins sheet 78)
(Joins sheet 87)
285 000 FEET
NIOBRARA COUNTY, WYOMING
T. 11 S.
18
17
16
19
20
21
28
29
30
31
32
33
Alkali Creek
PeB
PsE
He
KyA
PgE
GsD
GrE
Sw
SbD
BrD
SaE
N
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
1
0.5

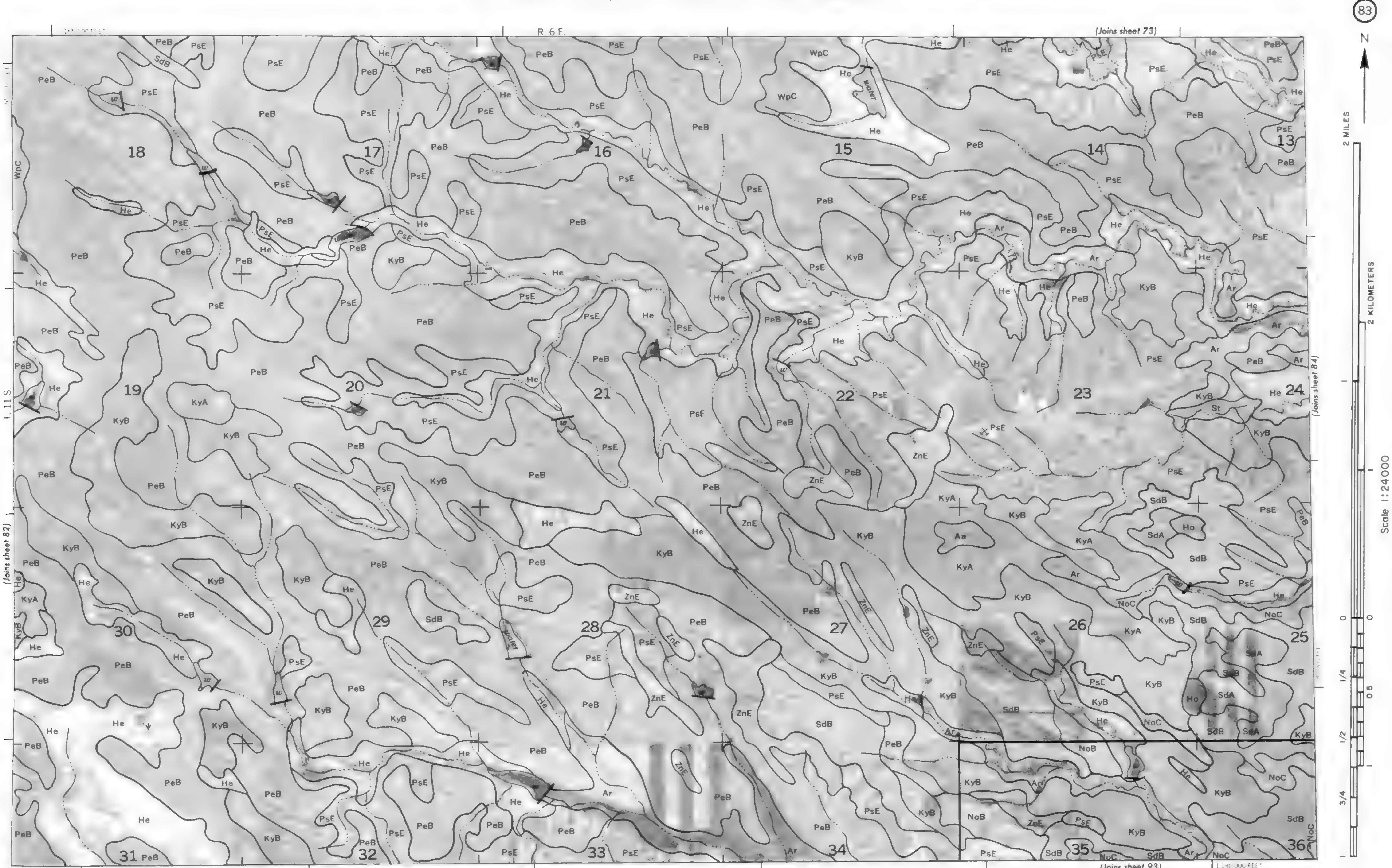

N
2 MILES
2 KILOMETERS
Scale 1:24000
(Joins sheet 68)
(Joins sheet 77)
(Joins sheet 79)
(Joins sheet 88)
R 1 E.
R 2 E
T. 11 S.
Camp Creek
Alkali Creek
16
15
14
13
18
17
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32

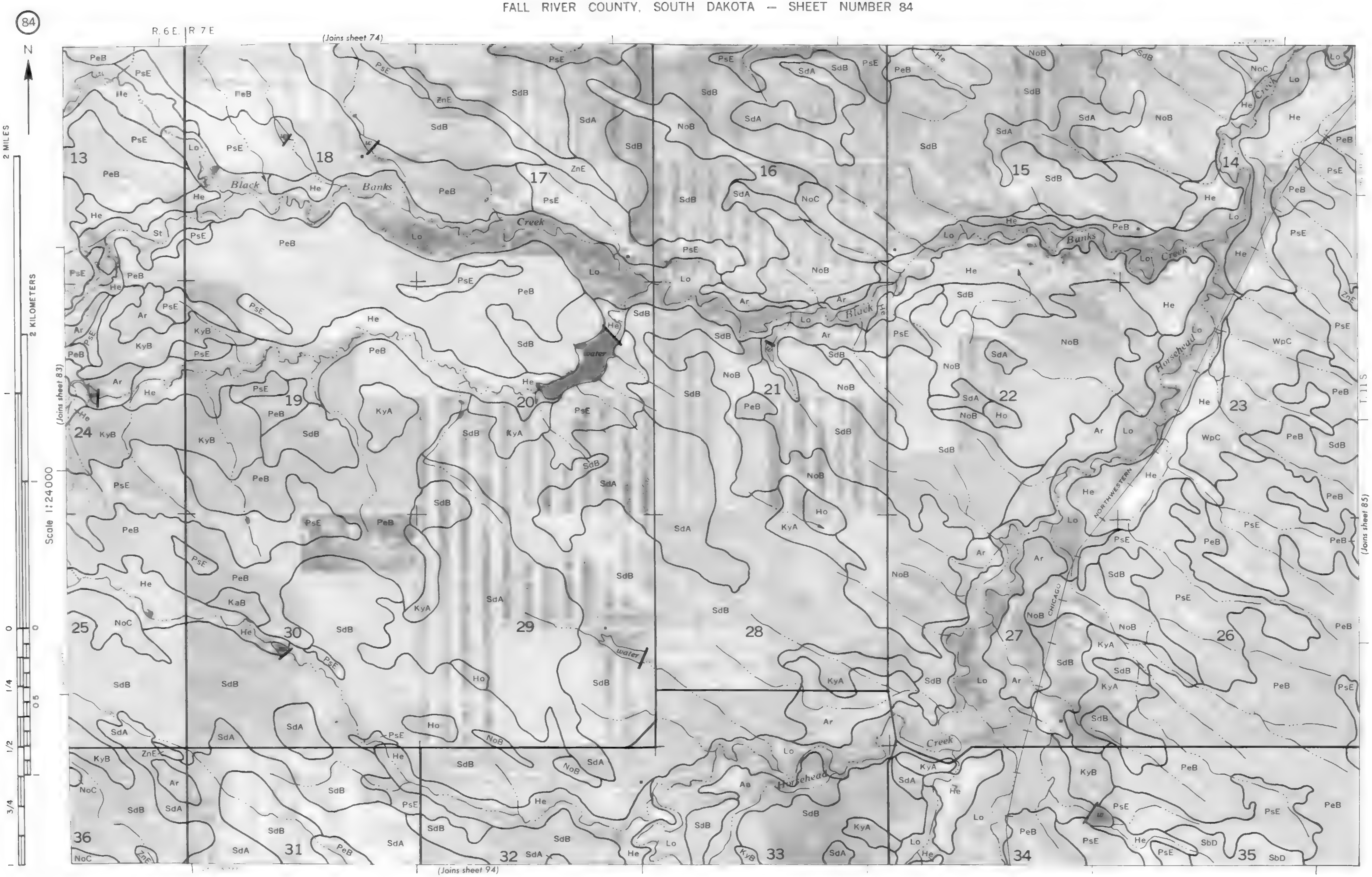

79
N
R 2 E. | R. 3 E.
(Joins sheet 69)
(Joins sheet 80)
(Joins sheet 89)
(Joins sheet 78)
T. 11 S.
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
1
0.5
Duck Creek
Cane
13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
PsE
PeB
He
KyA
Aa
St
SdB
Lo

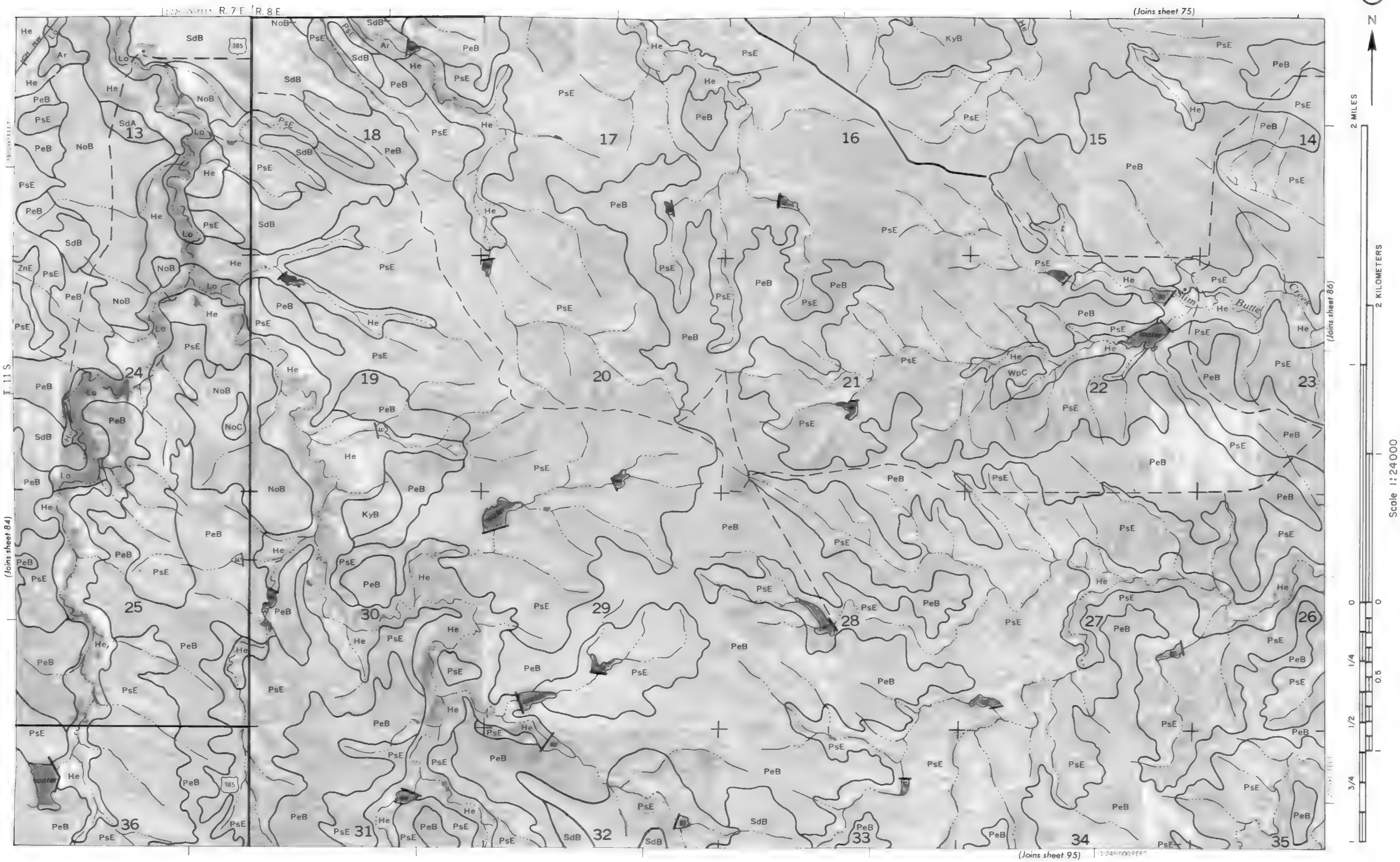

(Joins sheet 70)
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 90)
R. 3 E.
R. 4 E.
T. 11 S.
N
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
1
0.5
2
17
16
15
14
13
18
20
21
22
23
24
19
29
28
27
26
25
30
32
33
34
35
36
31
Duck Creek
Duck Creek

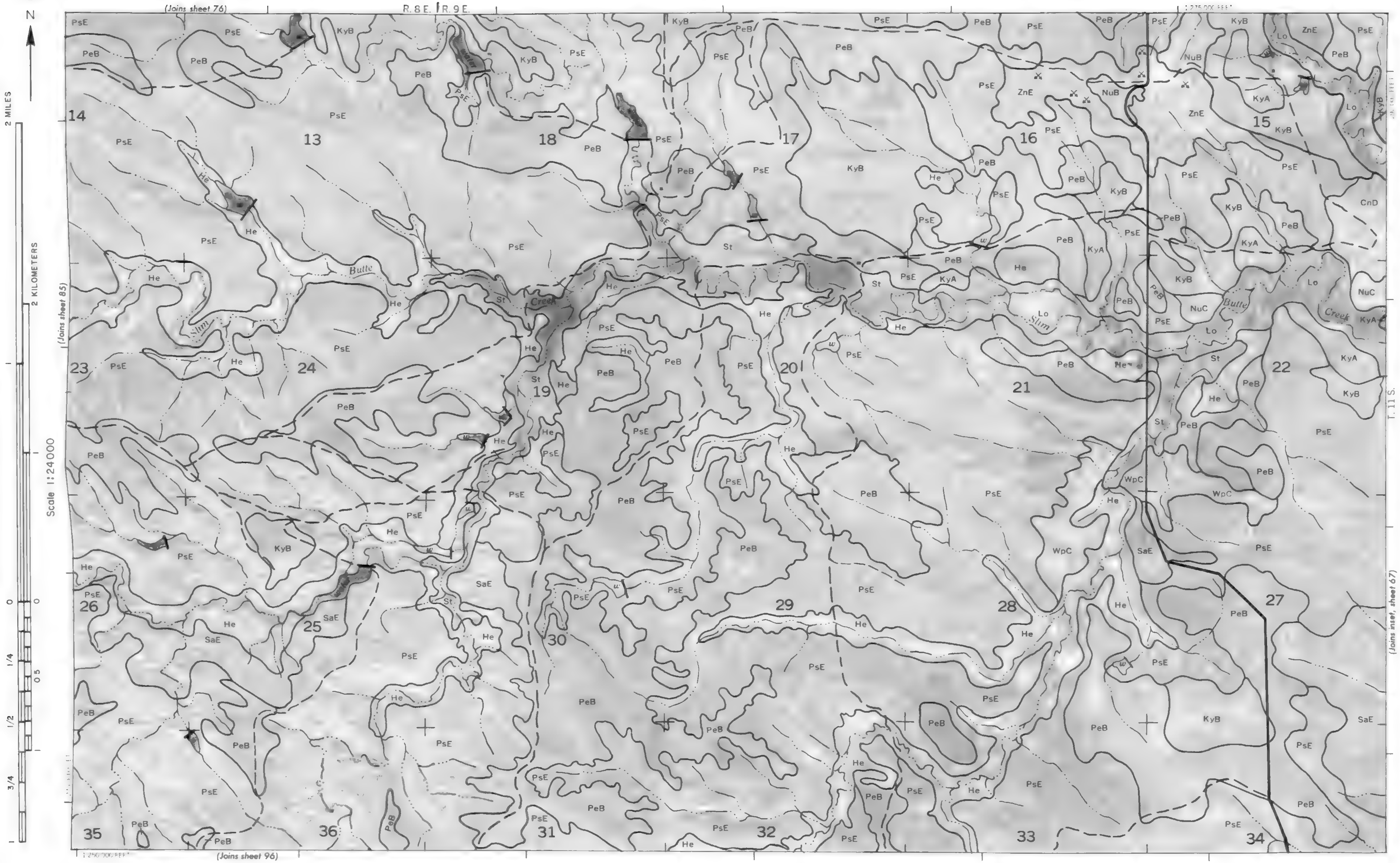

(Joins sheet 71)
R. 4 E. | R. 5 E.
(Joins sheet 80)
(Joins sheet 82)
(Joins sheet 91)
T. 11 S.
1 130 000 FEET
N
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
BURLINGTON NORTHERN
71
water
Hat Creek
Duck Creek
Mule Creek
Hay Creek
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

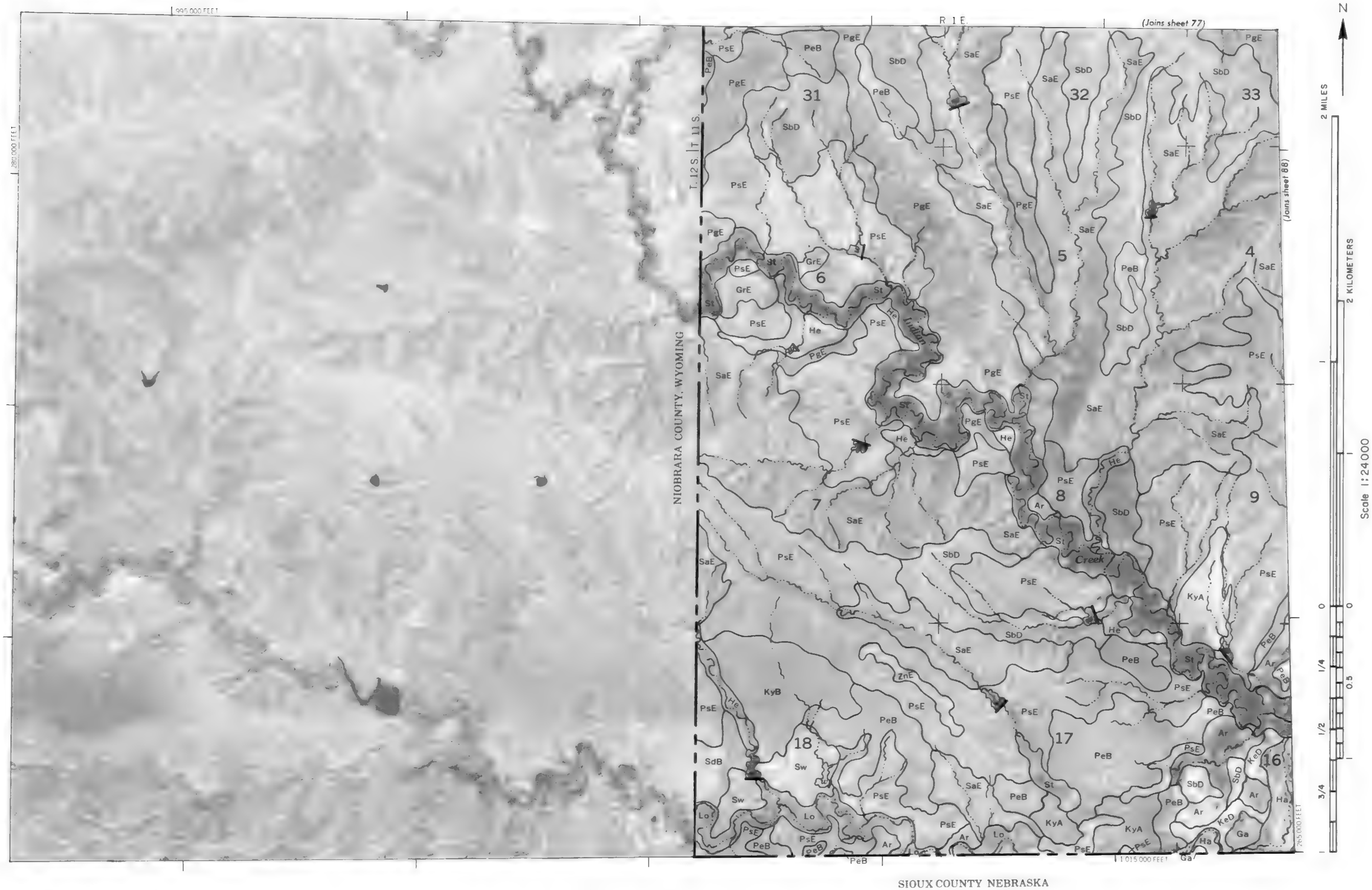

(Joins sheet 72)
R. 5 E.
1 160 000 FEET
(Joins sheet 81)
(Joins sheet 83)
(Joins sheet 92)
1 135 000 FEET
T. 11 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
Hay Cr.

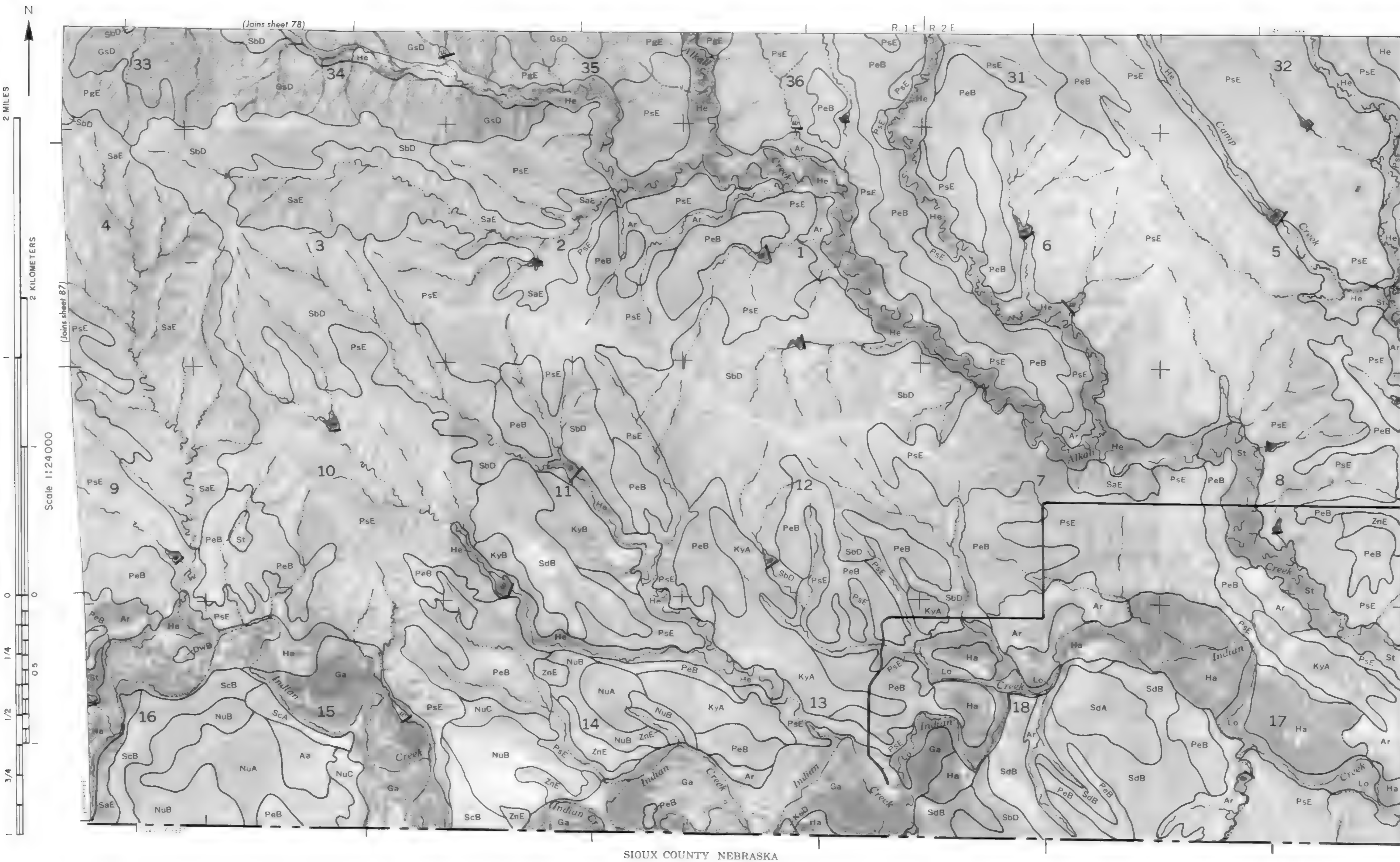

83
N
(Joins sheet 73)
(Joins sheet 84)
(Joins sheet 82)
(Joins sheet 93)
R. 6 E.
T. 11 S.
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
0.5
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
PeB
PsE
He
KyB
KyA
SdB
SdA
ZnE
WpC
Ar
St
Aa
Ho
NoC
NoB
water

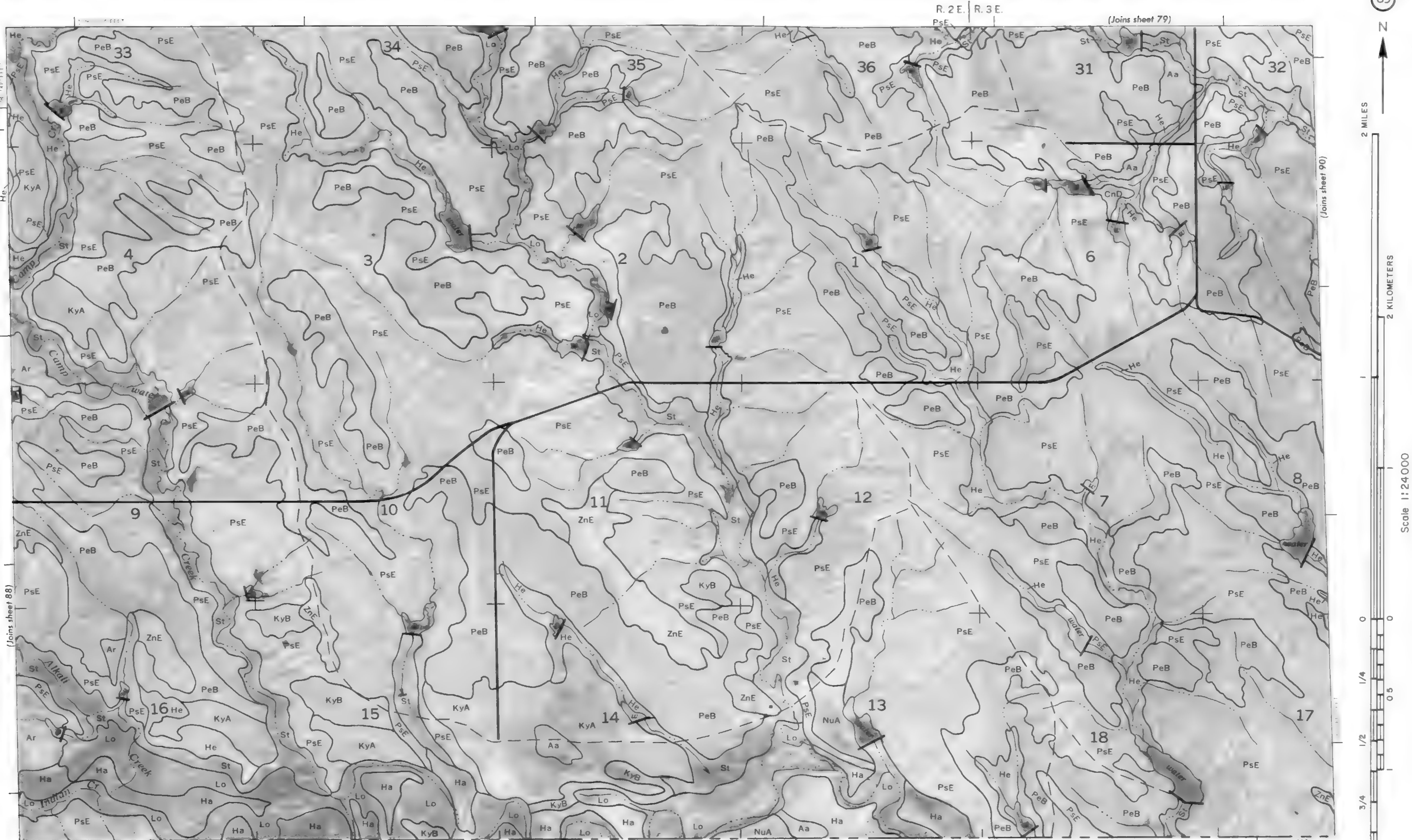

84
N
R. 6 E. | R 7 E
(Joins sheet 74)
(Joins sheet 83)
(Joins sheet 85)
(Joins sheet 94)
T. 11 S.
2 MILES
2 KILOMETERS
Scale 1:24000
0
1/4
1/2
3/4
1
0.5
Black Banks Creek
Horsehead Creek
Black Creek
CHICAGO NORTHWESTERN
water
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36


85
R. 7 E.
R. 8 E.
(Joins sheet 75)
(Joins sheet 84)
(Joins sheet 86)
(Joins sheet 95)
T. 11 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
Slim Butte Creek
water
385
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
He
Ar
Lo
SdB
SdA
NoB
NoC
PeB
PsE
ZnE
KyB
WpC

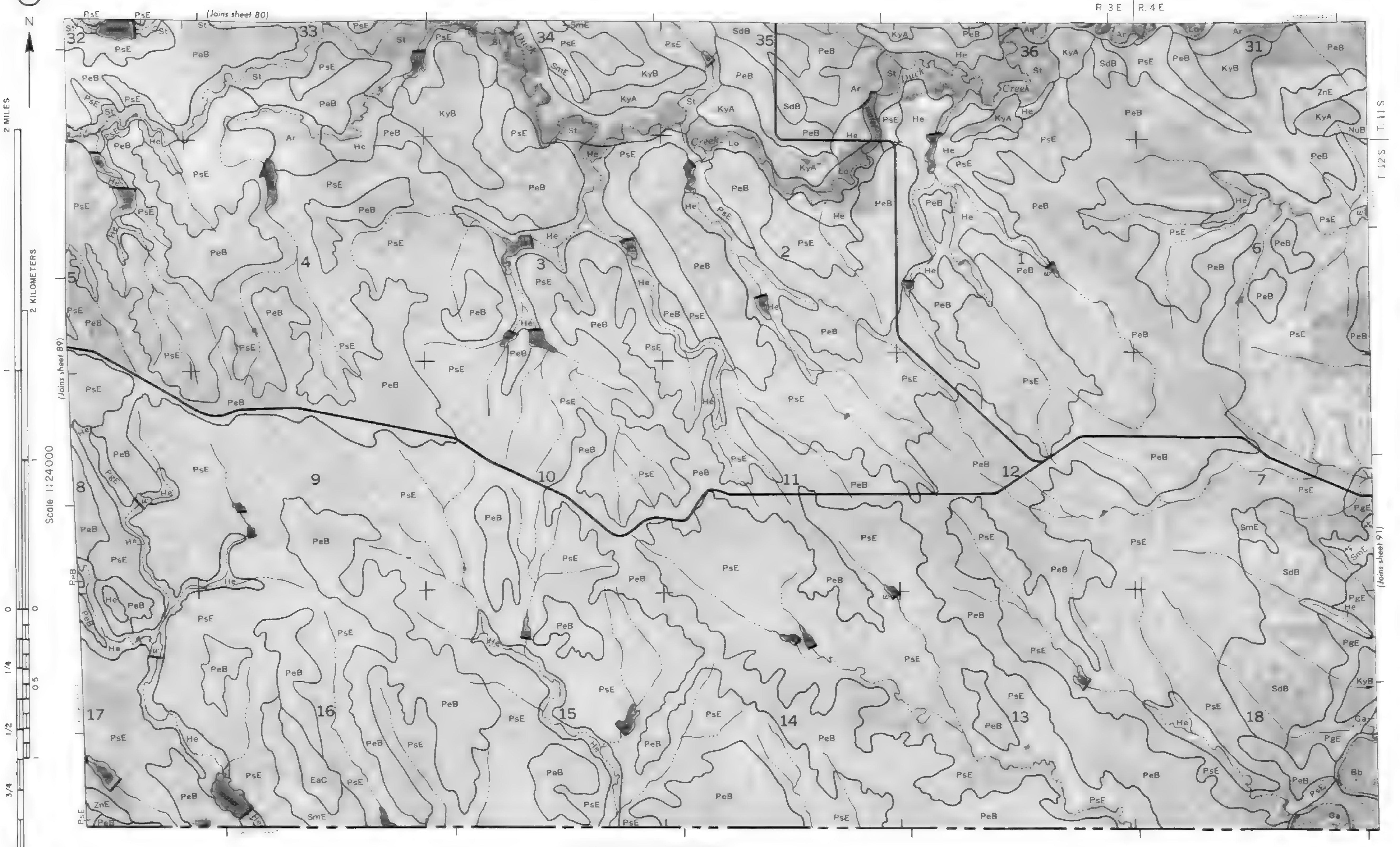

(Joins sheet 76)
R. 8 E.
R. 9 E.
(Joins sheet 85)
(Joins sheet 96)
(Joins inset, sheet 67)
T. 11 S.
N
2 MILES
2 KILOMETERS
Scale 1:24000
Butte Creek
Slim
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
PsE
PeB
KyB
KyA
He
St
SaE
WpC
ZnE
NuB
NuC
Lo
CnD


87
N
995 000 FEET
280 000 FEET
R 1 E.
(Joins sheet 77)
(Joins sheet 88)
T. 12 S. | T. 11 S.
NIOBRARA COUNTY, WYOMING
SIOUX COUNTY NEBRASKA
1 015 000 FEET
265 000 FEET
Indian
Creek
31
32
33
5
4
6
7
8
9
16
17
18
2 MILES
2 KILOMETERS
Scale 1:24 000
0
1/4
1/2
3/4
1
0.5

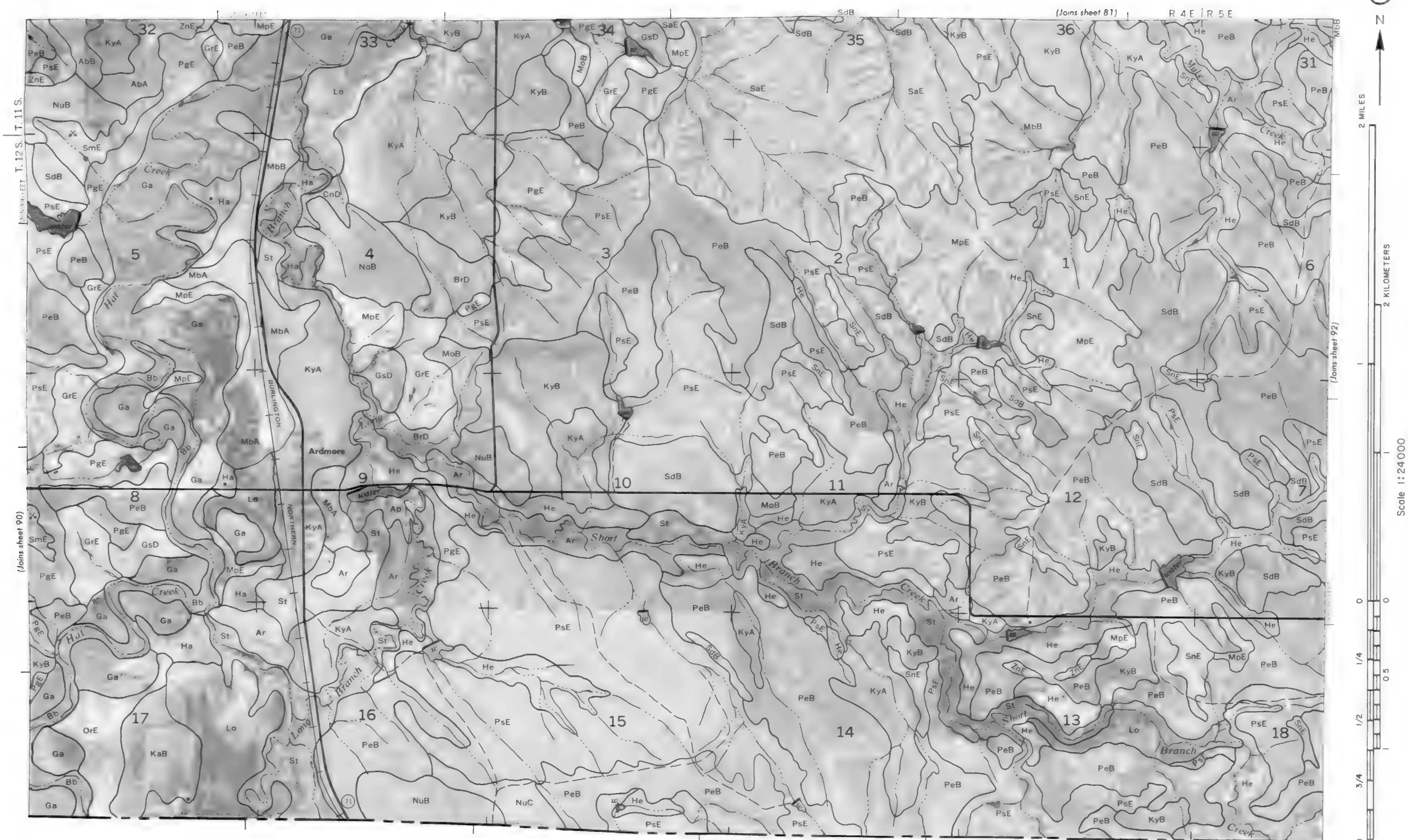

N
(Joins sheet 78)
(Joins sheet 87)
(Joins sheet 89)
R. 1 E.
R. 2 E.
T. 11 S.
T. 12 S.
2 MILES
2 KILOMETERS
Scale 1:24 000
Alkali Creek
Camp Creek
Indian Creek
Indian Cr.
SIOUX COUNTY NEBRASKA



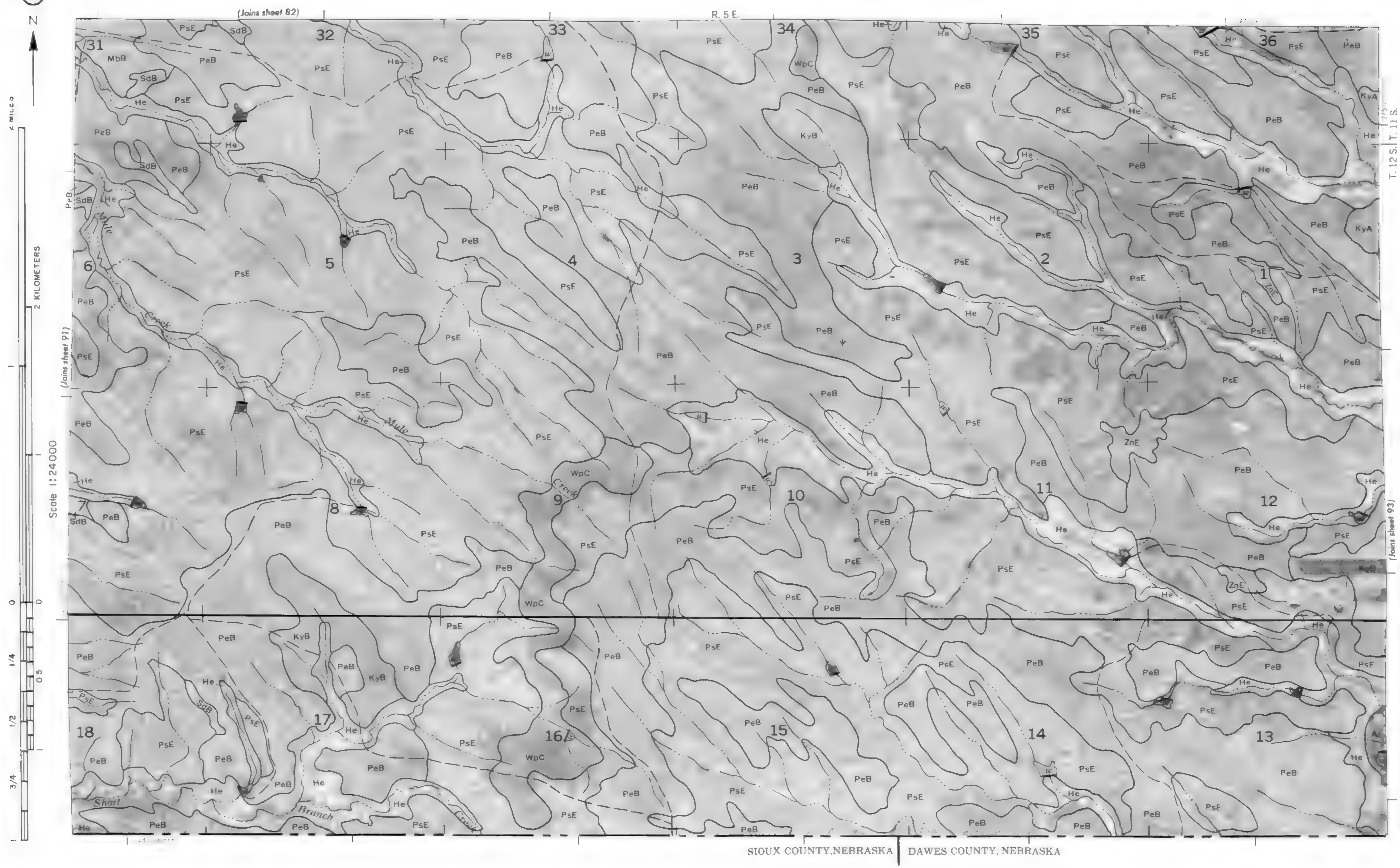
SIOUX COUNTY, NEBRASKA

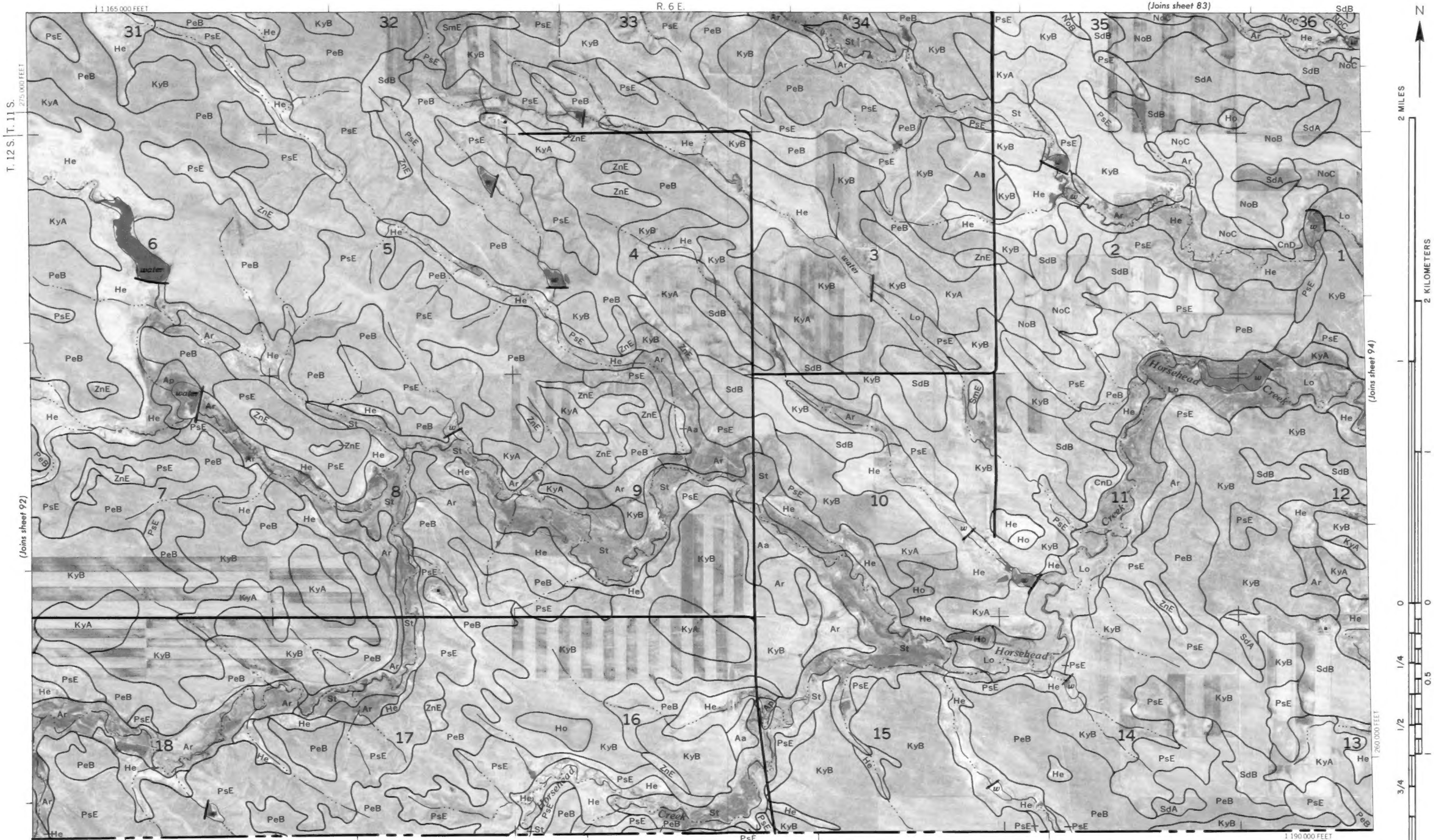


SIOUX COUNTY, NEBRASKA



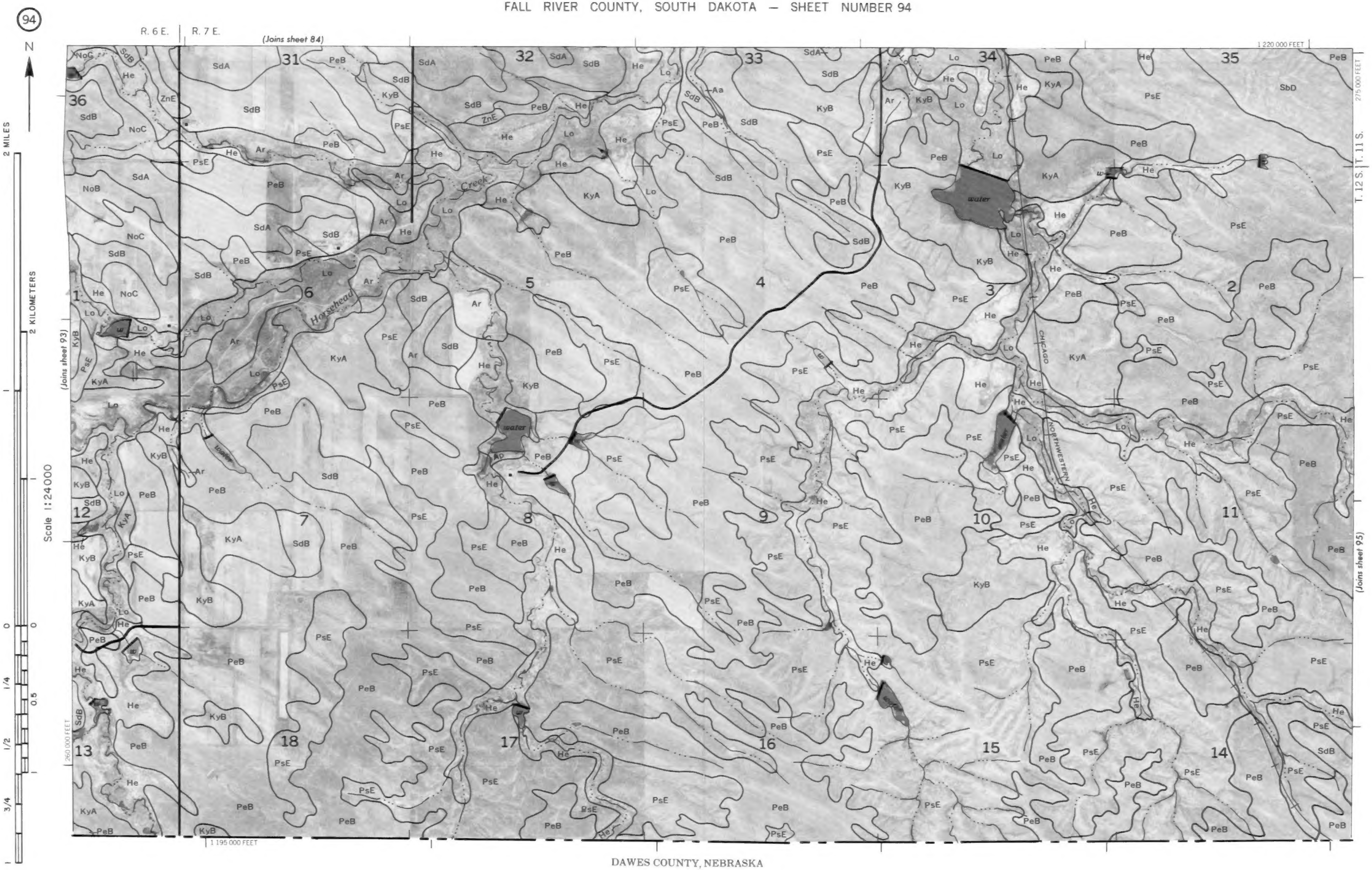
SIOUX COUNTY, NEBRASKA

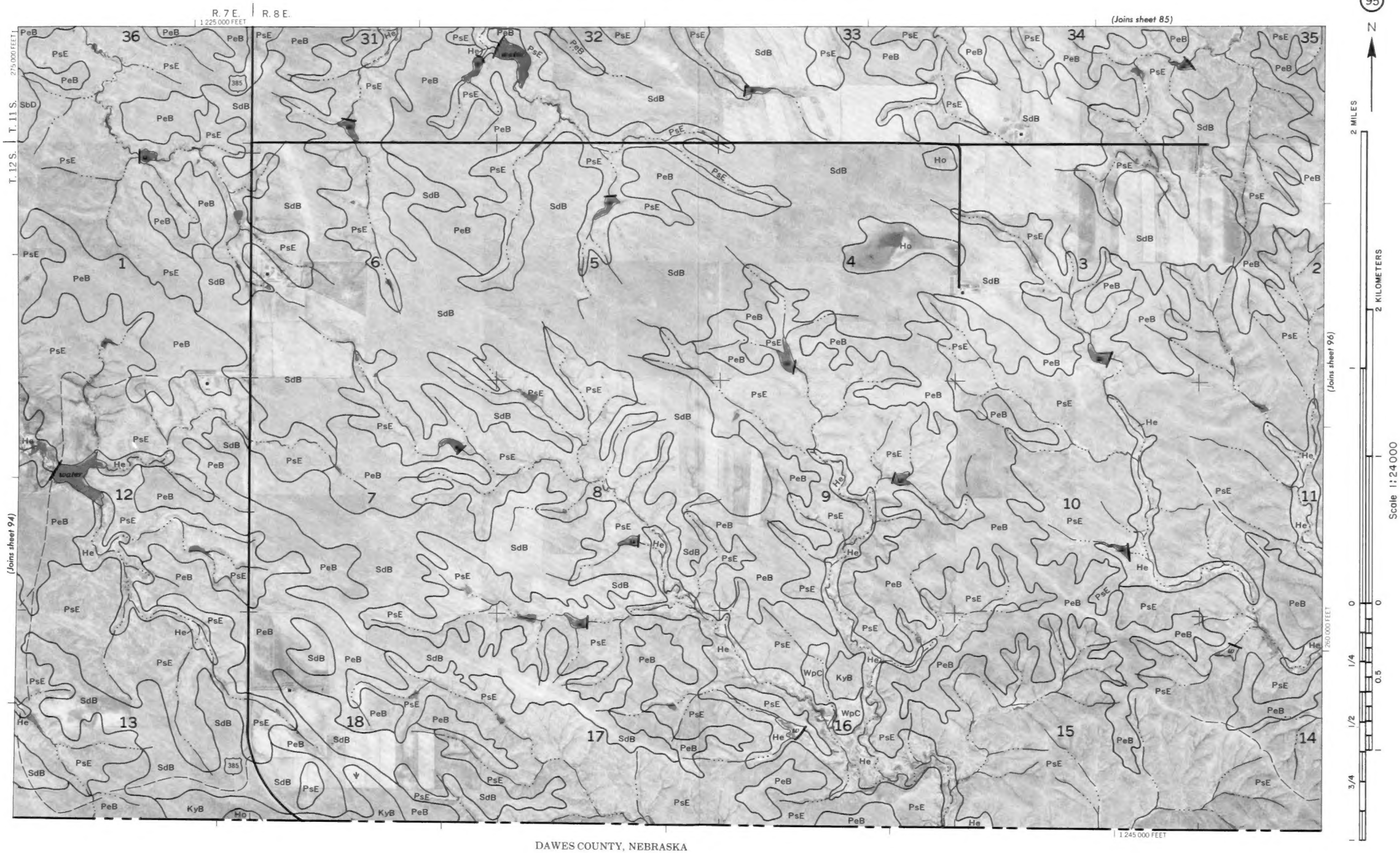

(Joins sheet 82)
R. 5 E.
T. 12 S. | T. 11 S.
(Joins sheet 91)
(Joins sheet 93)
N
2 MILES
2 KILOMETERS
Scale 1:24 000
SIOUX COUNTY, NEBRASKA
DAWES COUNTY, NEBRASKA
Mule Creek
Short Branch Creek

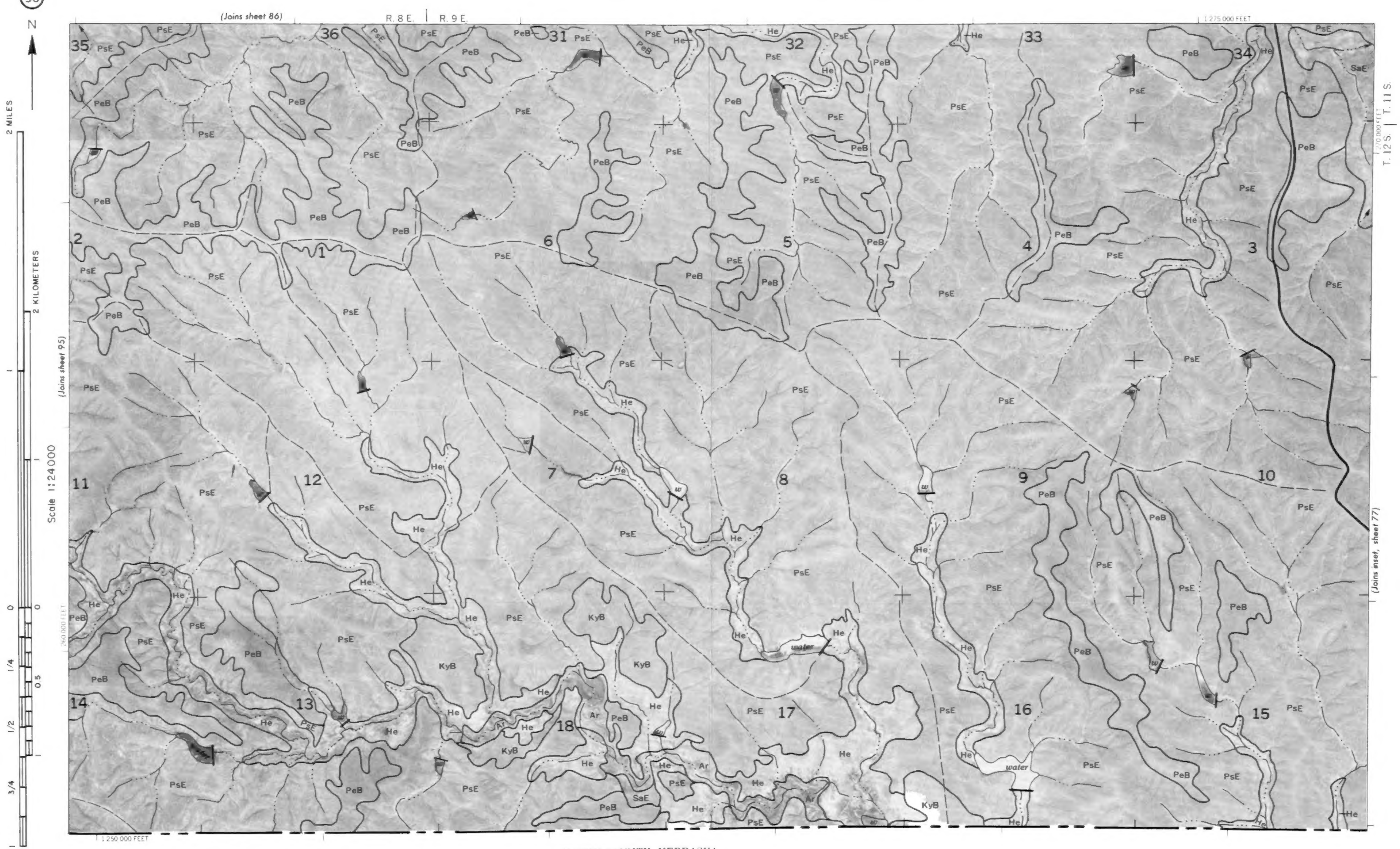


DAWES COUNTY, NEBRASKA

FALL RIVER COUNTY, SOUTH DAKOTA — SHEET NUMBER 94




95
R. 7 E.
R. 8 E.
1 225 000 FEET
275 000 FEET
T. 11 S.
T. 12 S.
(Joins sheet 85)
(Joins sheet 94)
(Joins sheet 96)
260 000 FEET
1 245 000 FEET
N
2 MILES
2 KILOMETERS
Scale 1:24000
1
0
0
1/4
0.5
1/2
3/4
36
31
32
33
34
35
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
385
water
PeB
PsE
SdB
SbD
He
Ho
KyB
WpC
DAWES COUNTY, NEBRASKA



DAWES COUNTY, NEBRASKA